CENTRAL ST. CROIX COUNTY WASTEWATER TREATMENT PLANNING FEASIBILITY STUDY

PHASE 1 REPORT
WASTEWATER EFFLUENT DISCHARGE ALTERNATIVES

A. MISSISSIPPI RIVER DISCHARGE ALTERNATIVE
B. GROUNDWATER DISCHARGE ALTERNATIVE
C. WILLOW RIVER DISCHARGE ALTERNATIVE

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A. INTRODUCTION

The Central St. Croix County Regional Wastewater Planning (CSCCRWP) Commission has been created to evaluate regional wastewater treatment issues within the St. Croix and Pierce Counties region. This region has seen a dramatic increase in residential and commercial development that has or will place their wastewater treatment infrastructure at capacity. As will be explained in this report, there are a variety of issues that need to be analyzed to determine what solution or set of solutions can be used to address this regional problem. The Commission has determined that the first step in this process is to perform a comprehensive Feasibility Study to select the best management practice for treated wastewater discharges for the communities in this region. The selection of the method and location of effluent discharge determines the effluent discharge limitations that will be applicable through WPDES permitting. The required effluent limitations specify the type of treatment technology that will need to be implemented by member communities to assure compliance.

Phase 1 of the Central St. Croix County Wastewater Treatment Planning Feasibility Study involves the initial study of three effluent disposal alternatives. These alternatives can be applied to address the emerging wastewater treatment capacity issues within CSCCRWP Commission member communities. These communities have been notified by WDNR that present regulations and policies set conditions that make it difficult to approve requests for increasing their treated wastewater discharges to their present locations. Several potential long-term solutions to this regional problem have been proposed. The regulatory, political, environmental, economic and human health impacts of each potential solution must be assessed so that the most cost-effective and environmentally sound solutions are identified for member communities.

The Commission has received a Water Quality Planning Grant from the WDNR to fund the initial phase of the feasibility study. The amount of this grant is not sufficient to allow a complete review of all the implications of the effluent discharge options that are available. The Commission has ranked the available alternatives and selected a minimum of two alternatives to assess in this phase of the feasibility study. The ultimate purpose of this analysis will be to determine whether a selected alternative should be eliminated from further consideration or be used to support a regional wastewater treatment solution. An additional purpose of this phase of the Feasibility Study is to identify and discuss the issues related to each alternative and identify possible additional analysis to support a desirable option. This additional work may have to be performed in a future phase of the Feasibility Study when additional funding becomes available.

B. PROJECT BACKGROUND

Recently, the communities of Central St. Croix County along the I-94 corridor have experienced a large increase in requests for development of properties near or in their corporate boundaries for home-sites and businesses. This expanded growth is the result of increased pressure from the Twin Cities Area as developable land is consumed. This type of growth is the result of the human desire to live in a quiet rural setting away from the urban area, which has a larger job base. The capability to commute along developed infrastructure routes from desired living areas to industrial and commercial centers supports this growth. Additionally, a certain amount of commercial and industrial development will follow this population base, locating itself closer to customers or potential employees.

During the last several years, the monthly meeting agendas of area communities have been filled with presentations from developers on plans to develop surrounding properties. The infrastructure within the communities in this area has a finite amount of capacity for additional development to occur without exceeding design requirements. This is particularly true for the wastewater treatment infrastructure currently in place. Many communities have allotted their last remaining wastewater treatment capacity, and treatment system upgrades are due. Facility plans are needed to provide new capacity for an increased growth rate for the next 20 years.

Typically, as a community's wastewater treatment system reaches its capacity a facility plan is performed which considers the effluent requirements for a nearby discharge point. However, the normal process is complicated for this region because the communities of Central St. Croix County lie within an area that is designated by the WDNR as being environmentally sensitive. Most of the potential receiving waters near these communities are classified as Outstanding or Exceptional Resource Waters. The State of Wisconsin has restricted the use of these possible effluent receiving waters by code and protected the status of these streams under anti-degradation rules. Currently, there is no practical way of controlling the amount of pollution entering these waters from overland runoff. However, very restrictive controls have been placed on point source discharges. It is WDNR's position that when existing wastewater treatment system design capacity is reached, no additional discharges to existing outfall locations will be permitted (i.e. Twin Lakes, linear seepage cells, etc.). WDNR has stated that growth may be needed to be curtailed if an acceptable long-term solution is not found. This is not an acceptable alternative for communities within this region.

The citizens of the communities within the Central St. Croix County region are environmentally conscientious citizens. Community leaders realized several years ago that as the increased pressure for development began, a long-term solution must be found. Several attempts to develop individual community facility plans did not produce a solution because reasonable, achievable, and cost effective effluent limits could not be obtained for discharge to locally available receiving waters. Several meetings were held to discuss the problem at a local level. No measurable progress was made, and the communities solicited the assistance of state legislative members.

On September 1, 2000, a meeting was arranged with WDNR in New Richmond, Wisconsin. Representatives of affected communities within the St. Croix and Pierce Counties region were in attendance at this meeting. Also in attendance at this meeting were area legislators and WDNR staff, including WDNR Secretary George W. Meyer. A presentation on area growth and wastewater treatment issues facing these St. Croix and Pierce County communities was made and a list of alternative solutions was presented. (These alternatives are discussed in a later section of this report.) During this meeting it was made public that WDNR supported the alternative of transporting treated wastewater to the Mississippi River. The preferred point of discharge would be after the confluence of the St. Croix and Mississippi Rivers. Representatives of the WDNR also pointed out that this issue was a regional issue. Therefore a regional-based plan to address this issue should be developed. The communities in attendance at this meeting were encouraged to form a Commission to work on alternative analysis and develop a long-range solution to the problem.

Several of the communities being affected the most by the pressure of increased growth with little wastewater capacity have adopted resolutions to form an inter-governmental cooperative agency to work on this issue. The Central St. Croix County Regional Wastewater Planning Commission held its organizational meeting on December 5, 2000. The Commission received a grant through the WDNR's Local Water Quality Planning Program to perform Phase 1 of the regional wastewater Feasibility Study. Under the grant agreement, Phase 1 of the Feasibility Study must analyze a minimum of two possible treated effluent discharge alternatives. It has also required that the funds obtained could not be used to analyze the St. Croix River discharge alternative. The selection of this scope of study for the Phase 1 analysis is described in the next section of this report.

C. SUMMARY OF WASTEWATER DISCHARGE ALTERNATIVES

SCOPE OF PHASE 1 FEASIBILITY STUDY

The initial task of the Commission was to establish the scope of services that would be covered during Phase 1 of the Wastewater Treatment Planning Study. As discussed previously, there were 12 wastewater discharge alternatives that were identified as possible for Central St. Croix County area communities. The Wastewater Treatment Planning Grant stated that a minimum of 2 alternatives must be studied during Phase 1 of the Study. An advantage/disadvantage analysis was used to help in the selection process. This analysis is presented in Table C-1. All listed alternatives were discussed in-depth during the Commission's initial meeting held on January 16, 2001. After detailed discussion, the Commission selected the following alternatives to be the focus of Phase 1. The reason for each alternative's selection is also given.

Alternatives Selected to be Included in Phase 1 of the Wastewater Treatment Feasibility Study

1. Discharge Treated Wastewater to a Discharge Point on the Mississippi River Near Hagar City, WI. This effluent discharge option has been promoted by WDNR as their choice as the most favorable long-term effluent disposal option for communities of Central St. Croix County and Pierce County. Use of this option will most likely require wastewater to be treated to levels that are achievable using standard wastewater treatment technologies. Once the treatment and transport infrastructure is in place, this option may be considered a very good long-term solution to the problem. However, no information is available about the possible routes and physical component requirements for such a system. Once the physical components are established, the economics of this alternative can be evaluated for cost-effectiveness. Long and short range environmental impacts, effects on human health, and political ramifications this alternative also requires analysis. The Commission recognizes that the funding available for Phase 1 of the Study is not sufficient to cover a comprehensive analysis of all the issues this alternative raises. But it is also felt that an initial overview and cost projection of this option ought to be established so that a decision can be made whether or not to further evaluate this alternative in a future phase of the Study.

2. Discharge Treated Effluent to a Large Scale Groundwater Absorption System. This option is attractive for several reasons. It is possible that large local formations of acceptable soils exist that may be adequate for each community or a combination of communities to use as wastewater disposal sites. Although the cost of purchasing the land would be high, the size and length of transport facilities can be minimized. Wastewater treatment requirements for this type of proposal are achievable, and the treated effluent can remain within the watershed from where it was produced. Possible disadvantages for this option include localized zoning requirements and public opinion. The Commission feels that this option has a strong possibility to be the most cost-effective and environmentally sound solution for several of the area communities and ought to be evaluated during this phase of the study. This determination will conclude whether this option is a long-term solution or whether it can be used in the interim until an acceptable long-term solution can be developed.

3. Discharge Treated Wastewater to a Discharge Point on the Willow River Near Boardman, WI. The Commission determined that if available funds remain, a third alternative can be

analyzed. The alternative selected for this Phase of the Feasibility Study is the possible discharge to a stretch of the Willow River downstream of Boardman, WI. At the time of this selection, this stretch of the Willow River was not classified as an outstanding or exceptional resource waterway. However, the stretch of the Willow River where this discharge may occur has recently been reclassified as a Class III trout stream. This alternative is attractive only if achievable effluent limits are provided by WDNR for this discharge point. Costs for the transport facilities are minimal compared to the Mississippi River alternative. The Commission recognizes that this alternative may not be reasonable for some of the communities, but may be more applicable for a smaller sub-group of communities. The Commission also feels that it may be possible for all communities to benefit by the example of this analysis. There are several other potential receiving waters within the region that have characteristics similar to the Willow River. A parallel analysis for more localized discharge alternatives can be structured for any community by taking example of this effort. It has been decided that, if reasonable discharge limits are obtained and any funds were left, at least some portion of the analysis of this alternative ought to be provided in the Phase 1 Feasibility Study Report.

It was the Commission's goal to use the funding available for Phase 1 of the Study in an efficient manner. Studying all 12 possible solutions fully with the available funding was not possible. Therefore, the Commission was forced to evaluate and prioritize the alternatives and choose the most desirable for study to the fullest extent possible with the available funding. The remaining alternatives were either unachievable because of their cost effectiveness, or were left for investigation during future Phases of the Study, (if and when funding is obtained).

The following is a list of options chosen not to be studied in this Phase, along with a summary of the reasons they were not selected and an opinion as to whether they should be dropped from consideration altogether or studied more carefully in the future.

Alternatives Not Selected to be Included in Phase 1 of the Wastewater Treatment Feasibility Study

- <u>Obtaining Variances to Permit Increased Flows to Existing Effluent Discharge Points</u>. This option may be the most ideal option for area communities for many reasons. This option allows communities to proceed with wastewater planning independently if they so choose to. This is a common way communities handle wastewater treatment issues related to growth. However, WDNR has stated in numerous communications with the Commission's member communities that increased effluent wastewater flow to the existing discharge locations will not be permitted. The inclusion of work related to developing this alternative is assumed to be ineligible for funding by the Wastewater Treatment Planning Grant provided by WDNR for this or any future phases of the study. The Commission wishes to establish the selected long-range effluent disposal alternative in a cooperative effort with WDNR. Because of these reasons, this alternative was not selected as part of the work scope for Phase 1 of the Study. It should also be dropped from consideration for future phases of the study because it is not fundable.
- <u>New or Expanded Discharges to Linear Seepage Cells (Dry Run Discharges)</u>. This option would also be an ideal option because several of the communities in this area already utilize this method of effluent disposal in their existing treatment plants. Other communities can easily convert to this method and implementation costs would be low. This method also keeps the wastewater discharges within the watershed from where they were generated. However, WDNR has published a position paper against approval of new linear seepage

cell disposal systems and has indicated that existing systems using this method will not be able to have permits approved for increased flow. The Commission also recognizes a potential impact on human health associated with this discharge alternative. Specifically, the potential for human contact with untreated wastewater effluent is possible. Therefore, the evaluation of this alternative is not considered as part of the work scope for Phase 1 of the study. Because this discharge alternative has been analyzed in detail by WDNR in previous studies, it is recommended to drop this alternative from consideration for future phases of the study. It is felt that further investigation of this alternative is not be fundable.

- <u>Treat Wastewater to Background Levels and Discharge Treated Effluent to the Lower St. Croix River.</u> The Lower St. Croix River is classified as an Exceptional Resource Waterway by WDNR. Therefore, under current regulations, any new wastewater flow discharged into this receiving water must be treated to background levels. The economics of this option have been previously developed, funded by the individual member communities of the Commission. If it were possible to treat to background levels economically, then this option would be competitive against many alternatives requiring an extensive wastewater transport system. However, wastewater treatment to these levels will require technology that is not economical. WDNR has stated they will not approve new discharges to the St. Croix River. Therefore, the evaluation of this alternative should not be considered as part of the work scope for future phases of the study.

  However, there is a possibility that our increased discharge effluent with conventional limitations for member communities may be approved to the St. Croix River if the discharge occurs through an existing outfall. The logical facility for this is the existing City of Hudson's outfall. This issue is complex and requires contemplation by all parties involved. From a WDNR regulatory standpoint, is this legally viewed as an increased discharge on an additional discharge? Inter-community relationships and cost-sharing structures will be required and political concerns will need to be addressed. However, the cost benefit that this option produces is substantial. It is recommended that this alternative be evaluated in a future phase of the study.

- <u>Discharge Treated Effluent to a Discharge Point on the Eau Galle River</u>. This option is feasible and, like the Willow River at Boardman, WI, alternative, may be best suited for a smaller flow from an individual community or subgroup of communities. The Eau Galle Impoundment is a 303D listed body of water, and additional nutrient loading may not be permitted at, or upstream of, this point. Use of a discharge point downstream is more likely to receive favorable effluent limits. Because of the similarity with the Willow River alternative, consideration of this option as a more localized discharge option for certain member communities ought to be designated for evaluation during a future phase of this study.

- <u>Discharge Treated Effluent to a Discharge Point on the Red Cedar River</u>. This option is similar to the Mississippi River option because it requires an extensive network of transport infrastructure. For several of the southern and western communities in this region, this option is even farther away than the Mississippi River option and requires more pipeline and larger lift stations. Like the Eau Galle River alternative, the Red Cedar River is 303D listed for pH and entruphication from mile 9 to mile 13. This section of the river includes Lake Menomin and a portion of the river downstream from this impoundment, and additional nutrient loading upstream of this body of water is not permitted. The effluent discharge point for this alternative will need to be below this point. Because the Commission has already selected an alternative that requires the evaluation of an extensive infrastructure system, this alternative has been eliminated from further evaluation in the Feasibility Study.

- Discharge of Treated Effluent to the Surface Water of Casey Lake. This option has been introduced as an alternative that allows the treated effluents to be discharge into the groundwater, thus remaining in the local watershed. Casey Lake is the upper reaches of the Kinnickinnic River watershed, and normally has no outlet. When wet weather occurs, overflow from Casey Lake becomes the beginning of the Kinnickinnic River. The geology of the area suggests that this body of water is directly linked to the groundwater through fractured bedrock underneath the lake. Unless precipitation rates are very high, inflow from run-off entering the lake is discharged into the groundwater rather than being discharged in the overflow. The area is currently owned by the State, and is used by the public for recreation. Again, this option is only feasible as a local alternative. The larger Communities in the southern part of the planning area are not able to use this alternative. This alternative requires an exhaustive effort to study, and it is highly likely that it will encounter political resistance from area conservation groups and WDNR staff. Therefore, the Commission has decided that this alternative be eliminated from further evaluation in the Feasibility Study.

- Allow Additional Growth to Occur Using Individual On-site Treatment Systems. This alternative is feasible because of new Wisconsin Department of Commerce Legislation. The "Com-83" rules set standards for individual on-site treatment systems and their discharges into the nearby soil. The standards are different than standards set for centralized community-based wastewater treatment system discharges to groundwater. Therefore, implementation costs for this approach are reasonable. However, there are severe potentials for environmental impact if large-scale growth is allowed using this type of wastewater treatment. Water supplies to existing communities may become impacted and the potential for effects on human health will be increased. The governmental bodies of existing communities would have little support for this alternative unless it is the last economical alternative available to them. The Commission has taken a position against large scale development using this type of wastewater treatment. This alternative is recommended to be dropped from further evaluation in future phases of this study.

- Transfer of Untreated Wastewater to the MPCA/Metropolitan Council for Treatment and Disposal. If transport of treated wastewater to the Mississippi River for disposal is a possibility, then it is reasonable that transfer of the wastewater across the St. Croix River to the interceptors being constructed by the Metropolitan Council in Minnesota is possible from a technical point of view. However, the Commission considers this alternative the least favorable option for many reasons including an environmental and human health concern of extensive transport of untreated wastewater, and the complexity of transferring it under the St. Croix River. The Commission is also concerned about the lack of control over the cost for treatment and the complexity of an inter-governmental agreement between communities of different States. Area politicians have already stated that they are opposed to this option and that State of Wisconsin funding for implementation will not be approved. (A letter from Senator Harsdorf regarding this subject is provided in the Appendix of this report.) For these reasons, this option has been eliminated from further evaluation in any future phases of this study.

- Discharge of Treated Wastewater via Spray Irrigation. This is another alternative that can be used by certain communities or groups of communities in this area, and will keep the wastewater discharges within the watershed from which they originated. Discharge of wastewater via this method can only occur during warm weather when vegetation is capable of growing. Therefore, seasonal storage of treated effluent is required. The size of the storage lagoons and spray fields become very large as flow capacity increases. The larger communities in the region may not be able to use this option due to site size requirements. Smaller communities will find this option increasingly costly as they grow. These facts, in addition to public opinion concerns and possible human health risks due to transport of air-borne contaminants, make this option a poor choice as a long-term solution. The Commission's opinion is that this option should be eliminated from further evaluation in future phases of the study.

- Leave the Area's Wastewater Treatment Systems as They Are and Stop Growth and Development in the Region. WDNR personnel have introduced this option as an alternative. Under this scenario, growth in the region will continue until each community's wastewater flow reaches the design capacity of its treatment system. Then, a sewer moratorium can be imposed by WDNR if significant non-compliance of the treatment systems occur. Once treatment capacity has been reached, additional growth could only occur using on-site treatment technology. Residential development using on-site systems would then occur surrounding each municipality. This type of growth leads to loss of control for wellhead protection programs of the municipality. This is the last and least acceptable alternative available to the Commission. The Commission has taken the position that this "no growth" scenario is not acceptable and is not worthy of an evaluation in any phase of this study. No effort will be expended on studying this alternative.

Table C-1
The Central St. Croix County Regional Wastewater Planning Commission
Possible Wastewater Discharge Alternatives

Alternatives	Advantages	Disadvantages
1. Increased flows to existing discharge points.	1. Most ideal option – individual solutions for each community. 2. Lowest cost option because no large-scale multi-community project is needed. 3. Keeps wastewater in watershed.	1. Sewer moratorium may be imposed if non-compliance occurs. 2. Plants may be or may become out of compliance. 3. Less or no public funding support will be available. 4. Possible legal action by state environmental enforcement agencies.

Table C-1 (Continued)

Alternatives	Advantages	Disadvantages
2. New or expanded discharges to linear seepage cells.	1. Several communities are already using this method. 2. Easy to find local discharge points. 3. Keeps wastewater in watershed.	1. WDNR has issued a statement prohibiting new discharges to linear seepage cells. 2. Possible human health effects. 3. Requires large buffer zone to prevent human contact.
3A. Treat to background levels and discharge effluent to the Lower St. Croix River.	1. If feasible, good long-term effluent discharge alternative for Commission member communities. 2. Some of the economics for this option for Commission member communities have already been developed. 3. Lower cost than most long-range transport options.	1. Specific effluent limits based on background levels have not been developed. 2. Cost for chloride removal alone is prohibitive. 3. New discharge point may not be permitted. 4. Expect legal action by environmental groups. 5. Will require polishing plant at discharge point.
3B. Use existing outfall to discharge wastewater to Lower St. Croix as an "increased discharge."	1. Good long-term option for member communities. 2. Economics have been partially developed. 3. Lower cost than most long range alternatives.	1. Requires sharing Hudson's existing outfall. 2. May affect future Hudson growth. 3. Legality of this option needs to be sorted out. 4. Political obstacles need to be removed. 5. Possible intervention by environmental groups expected.

Table C-1 (Continued)

Alternatives	Advantages	Disadvantages
4. Discharge treated effluent to the Upper Mississippi River.	1. WDNR has established that this is its recommended alternative option. 2. Once infrastructure is established, results in a very good long-term solution. 3. More lenient effluent limitations for Mississippi River have been established.	1. Capital Cost extremely high. 2. Small existing population base to support cost. 3. Long time frame to complete project. 4. Possible conflicts from other communities, counties, and states. 5. Cost to upgrade member community plants and to build a polishing plant must be included in the analysis of this option. 6. Legal action by environmental groups possible.
5A. Discharge to Eau Galle River.	1. May be good option for eastern member communities. 2. Expect more lenient effluent limits for this discharge alternative.	1. Upper sections of both rivers discharge into 303d listed impoundments. 2. Not good choice for southern communities.
5B. Discharge to Red Cedar River.	1. Good long-term option once infrastructure built. 2. Expect more lenient effluent limits.	1. Would require long run of piping to reach lower stretches of river – high cost. 2. Similar to Mississippi River alternative, except less assimilative capacity.
6. Discharge to the Willow River.	1. Good local alternative for western member communities. 2. Discharge point selected in section of river designated for "full fish and aquatic life" use. 3. Lower transport system capital cost.	1. Many sections of this stream are being reclassified as trout waters. 2. Discharges into Exceptional Resource waters of Lower Willow and St. Croix Rivers.

Table C-1 (Continued)

Alternatives	Advantages	Disadvantages
7. Discharge to Rush or Kinnickinnic Rivers.	1. Local discharge points for several communities. 2. Low transport costs	1. Background level treatment required. Rush – exceptional resource water Kinnickinnic – outstanding resource water. 2. Watched closely by environmental groups. 3. Legal action would probably be required if used.
8. Discharge to remote groundwater absorption system.	1. Highest potential for a localized long-term or intermediate solution. 2. Lower cost alternative than exhaustive transport systems. 3. Potential approvable sites available. 4. Can be used as individual option or smaller subparagraph option.	1. Cost of land acquisition high. May require one time payment to County because of tax exempt status. 2. Will require additional land for buffer zone. 3. Will require Nitrogen removal at treatment plant. 4. Soil requirements stringent. 5. Disinfection will probably be required because of potential of virus transport in groundwater.
9. Individual on-site systems for future development.	1. Low cost to Village. Cost borne by property owner. 2. Easy to implement.	1. Possible groundwater and public water supply contamination. 2. Limited amount of operational control. 3. Human health risk. 4. Local government opposition. 5. Low level of treatment achieved.

Table C-1 (Continued)

Alternatives	Advantages	Disadvantages
10. Transfer untreated wastewater to MPCA/Met council.	1. No need to treat wastewater. 2. No treatment system cost. 3. MET Council has the treatment capacity already.	1. High cost of transport infrastructure. 2. Crossing the St. Croix River and environmental concern. 3. Minnesota political opposition. 4. Wisconsin political opposition. 5. No control over treatment charges. 6. No funding available. 7. Opposition of Governmental representatives.
11. Spray/Drip Irrigation.	1. Treatment needs can be met by existing systems. 2. Water is reused in watershed.	1. Large land acquisition required – high cost. 2. Taking land off the township's tax roll. May require one time payment. 3. Location of property may be difficult. 4. Poor public opinion and high human health risks. 5. Poor long- term solution for developing area.

Table C-1 (Continued)

Alternatives	Advantages	Disadvantages
12. No project/stop growth.	1. No action required by Villages. 2. Low cost	1. Potential of being a long-term solution questionable. 2. No development is not an acceptable solution. 3. Will force on-site systems to be used surrounding communities. 4. No future for any community. 5. Some existing development already exceeds capacity in some cases. 6. No political or governmental support for this.

D. DEMOGRAPHICS

POPULATION PROJECTIONS

Effluent limits for the Mississippi River Discharge Option and the Willow River Discharge Option were requested to be calculated by WDNR in a letter dated February 2, 2001. This request required the establishment of 20-year population projections so that wastewater loading rates for the proposed wastewater treatment discharges could be established. This requirement was accomplished in several different steps as described below.

First, an accurate 20-year population projection was sought for each Commission member community. At that time, the Commission consisted of the Villages of Hammond and Roberts (The Villages of Baldwin and Woodville joined the Commission at a later date). Population projections for the Villages of Roberts and Hammond were made using data provided by the State of Wisconsin Department of Administration and the Mississippi River Regional Planning Commission through the year 2020 were used as a base. In addition, each of these communities had previously established growth projections during the development of individual comprehensive plans published prior to this study. The year 2020 population projection for these member communities is then the sum of the population projections published in the Comprehensive Plans for the Village of Roberts and the Village of Hammond. This information is presented in Table D-1.

Table D-1
Commission Member Community 20-year Population Projections

Hammond Population Projections			
Year	Population	GPD/PE	Flow
1995	1,153		
2000	1,195		
2005	2,850		
2010	4,500		
2015	6,200		
2020	7,800	75.61	589,932

Roberts Population Projections			
Year	Population	GPD/PE	Flow
1995	1,127		
2000	1,182		
2005	2,600		
2010	4,000		
2015	5,400		
2020	6,800	61.65	419,226

These projections have been used to calculate the wastewater loading rates provided to WDNR for establishment of effluent limits for the Willow River discharge option (see Section F). This discharge option is considered as a locally feasible option for a smaller sub-group of municipalities, and is not considered a region wide option. By location, the Villages of Roberts and Hammond are located appropriately to allow the Willow River discharge to be considered for a combined flow discharge. Table G-1 contains the projected 20-year loading information calculated for this discharge.

For the Mississippi River discharge option, a 50–year population projection for all possible member communities was required so that the sizing of transport systems and piping could be established.

The installation of this type of infrastructure is most cost effective if it is done using longer range projections. It is logical to install a pipe sized for 50-year-use once, rather than installing smaller 20-year designed pipes two or more times over a 50-year period. 50-year population projections were established by extending the 20-year projection to 50-years using a growth rate comparable to, but higher than, that established in the Minnesota Metropolitan Sewerage Council's South Washington County Interceptor (SWCI) Facility Plan published in 1998. The Metropolitan Council's projections were used to report "ultimate development flows".

The numbers suggest that the SWCI area will saturate its developable land within this time period and population growth will slow in this area. Therefore, it is reasonable to expect a higher potential growth rate farther away from the Twin Cities because there is more developable land available. For this study, it is assumed that the Central St. Croix County Community growth rates for the years 2020 to 2050 will be twice the rate projected in the Metropolitan Council's SWCI Study Area. Table D-2 presents the Metropolitan Council's population projections and the resulting projected growth rates assumed for the CSCCRWP Commission member communities.

Table D-2
50-Year Population Projections for Member Communities

Met. Council Facility Plan SWCI Area Population Projections			**Estimated 50 Year Growth Projections for Village's of Roberts and Hammond**		
Year	**Population**	**% Growth/Year**	**Year**	**Population**	
2000	73,750		2000	2,377	Growth rate is based on development projections from each Village's comprehensive plan and current development requests
2010	95,850	0.029966102	2010	9,500	
2020	122,600	0.02790819	2020	14,600	
2030	140,265	0.014408646	2030	18,807	Growth rate is based on Met. Council's SWCI Facility Plan Population Projections X 2
2040	157,831	0.012523438	2040	23,518	
2050	175,395	0.011128359	2050	28,752	

The Mississippi River discharge option is considered an option that can be used by all communities located in Central St. Croix County, as well as several communities within Pierce County. The calculation of effluent limits for this option required establishing flow and loading rates for all six possible member communities. Because several of these communities were not participating in the Commission at the time this phase of the study was performed, accurate population projections for these communities could not be established. For the purpose of this study, estimated 20-year wastewater flow rates for communities outside of the Commission were obtained by conversations with WDNR staff. Computation then established a 20-year population equivalent loadings for this entire regional discharge. A 50-year loading projection was established using the same method of comparison to the Metropolitan Councils SWCI Facility Plan projections as was used for the Commission member projections. Table D-3, D-4, and D-5 summarize the regional projections established for this report.

Table D-3
Member Community Design Flows and Population Equivalent

Member Community	Estimated Year 2020 Wastewater Flow	Calculated Population Equivalent
Roberts	419,226 GPD	6,800
Hammond	589,932 GPD	7,800
Total	1,009,158 GPD	14,600

(*69.1 GPD/PE established from actual flow data)

Table D-4
Non-Member 20-Year Design Flows and Population Equivalents Provided by WDNR Staff

Community	Estimated Year 2020 Wastewater Flow	Estimated Population Equivalent
Baldwin	800,000 GPD	11,428
Woodville	200,000 GPD	2,857
Ellsworth	1,000,000 GPD	14,286
River Falls	2,500,000 GPD	35,715
Total	4,500,000 GPD	64,286

(*estimated at 70 GPD/PE, source MetCalf & Eddy, 1991)

Table D-5
50-Year Flow Population and Flow Projections for Mississippi River Discharge Alternative

Year	MET Council SWCI Growth Rate/Year	Estimated CSCCRWP Commission Growth Rate/Year	Population	Wastewater Flow Rate
2020			78,886	5,509,158
2030	0.014408646	0.028817293	101,619	7,096,748
2040	0.12523438	0.025046876	127,071	8,874,262
2050	0.011128359	0.022256718	155,353	10,849,381

E. MISSISSIPPI RIVER DISCHARGE ALTERNATIVE

DESCRIPTION OF ALTERNATIVE

The Mississippi River effluent discharge alternative became an alternative that required serious attention on September 1, 2000. On that date, a meeting was held at the Cashman Center in New Richmond, WI. that was attended by area community representatives, state legislators, and WDNR staff. The meeting was held to discuss the issue of expanded growth in the region and its effect on wastewater treatment discharges from area communities. Several options for discharging treated effluent from municipalities located in Central St. Croix County and the northern portions of Pierce County were discussed. The option of discharging treated effluent from these communities via pipeline transfer to the Mississippi River was promoted by Mr. George Meyer, then Secretary of WDNR, as the most favorable alternative from an environmental point of view. It was stated that the Mississippi River south of the confluence of the St. Croix is designated with a fish & aquatic life stream classification and effluent limits could reasonably be met. The water quality of the Mississippi River in this area has already been impaired by discharges from the metropolitan areas of Minnesota. Opposition to this alternative would be less than other surface water discharge alternatives that involved outstanding or exceptional resource waters.

The alternative for the discharge of treated wastewater effluent to the Mississippi River involves the transportation of this effluent through a system of lift stations and pipelines to an acceptable discharge point. The ideal route of this system would be centrally located among the communities that would use it. The transport system would be a separate utility functioning on user charges collected from member communities that use its services. The transport system would begin in Central St. Croix County where a centrally located lift station would collect wastewater transported to it by Commission member communities. This lift station would transfer the wastewater south through the first forcemain section of piping towards the Mississippi. The route of the pipeline would be planned along existing public right of ways as much as possible to avoid conflict with landowners. The effluent discharge point would be located along an identified constriction of the Mississippi River where adequate mixing with the full flow of the River would occur. The effluent would require re-treatment in a polishing system prior to discharge.

WASTEWATER TREATMENT REQUIREMENTS PRIOR TO DISCHARGE

Effluent Limits Request

Effluent limits were requested for the Mississippi River discharge alternative in a letter to Mr. Scott Boran of WDNR on February 2, 2000. The Mississippi River discharge option is considered a large-scale regional option. Therefore, the effluent limits request for this discharge option was based on the loading expected from a 6 community member Commission with a 20-year population equivalent of 78,886. This population projection was developed in Section D, Tables D-3 and D-4 of this report. Based on this projection, 20-year loading projections were established. This loading information was provided to WDNR staff in the effluent limit request letter. Table E-1 presents this data.

Table E-1
Projected Loading Rates for Regional for the Mississippi River Discharge Option

PE Equivalent for Design Consideration	78,886
Average Dry Weather Flow	5,509,158 gpd
Peak Wet Weather Flow	16,527,474 gpd
BOD Loading	17,355 lbs/day
Suspended Solids Loading (with kitchen grinding)	20,510 lbs/day
Total Phosphorus Loading	631 lbs/day
Ammonia Nitrogen Loading	552 lbs/day
Total Kjeldahl Nitrogen (TKN) Loading	2,130 lbs/day

WDNR's procedure is to use the submitted flow and loading information to calculate required effluent limitations for the proposed discharge. The calculation of effluent limitations is very dependent on the proposed discharge location, classification of the receiving water, and the amount of flow to be discharged. WDNR responded to the effluent limit request for this discharge in its memorandum dated March 12, 2001. A copy of this letter is included in the Appendix. Table E-2 contains a summary of these requirements

Table E-2
Effluent Limitations for a Multi-Community Mississippi River Discharge

Parameters	Assimilative Capacity
BOD	45 mg/l weekly; 30 mg/l monthly average
TSS	45 mg/l weekly; 30 mg/l monthly average
PH	6.0-9.0 daily range
Ammonia	None; future limits may be necessary
Fecal Coliforms	400/100 ml monthly average
Chlorine	38 mg/l
Phosphorus	1 mg/l

Wastewater Treatment Requirements

The required effluent limitations for this effluent disposal alternative define the level of treatment required at each community's wastewater treatment plants. Generally, the type of treatment required for meeting limits of 30 BOD, 30 SS, 1 mg/l P and disinfection is achievable with typical secondary treatment technology. Most of the treatment systems used by the communities in this region have the capability of meeting this level of treatment or can be modified to meet this level of treatment. However, to achieve future ammonia limits, a system capable of nitrification will be required. The amount of modification required to achieve this level of treatment is specific to each community and its treatment system.

For member communities of the CSCCRWP Commission, the required modifications to meet these limits can be defined. If the nitrification/denitrification process to convert and remove nitrogen is required in the future, the existing systems must be modified or replaced to meet their capacity requirements. These modifications will involve increasing treatment capacity and adding activated sludge secondary treatment processes and adding a treatment process for phosphorus removal. Facility planning for each community to meet these requirements will be required.

A general overview of improvements that will be needed for the Village of Robert's RBC based wastewater treatment plant will be to increase capacity by adding additional primary and secondary clarification, and more RBC shafts. Associated support systems such as a new headworks and sludge transfer equipment can be added. Phosphorus removal can be obtained by chemical addition to the inflow of either the primary or secondary clarifiers. A new effluent lift station will transport treated effluent to the head of the effluent transport pipeline. However, if nitrification is required, the RBC process may need to be extensively modified or replaced with a new process. Because the effluent limits provided in WDNR's response to the Mississippi effluent limits request contain the footnote regarding possible future nitrogen limits, a complete wastewater processing change will likely be recommended for the Village of Roberts during facility planning.

The Village of Hammond's wastewater treatment system consists of an aerobic lagoon system. This type of process has limitations for treatment capability for nutrient removal. Facility planning will need to consider the capability of this type of treatment technology to meet long-term requirements. For the same reasoning applied above, a process change will likely be recommended in the Village of Hammond's facility planning. A new effluent lift station will be required to transport treated effluent to the head of the effluent transport pipeline.

The following tables show estimated wastewater treatment improvement costs for each of the above communities should a pipeline to the Mississippi River be constructed and the limits indicated previously are implemented. These cost estimates have been developed using cost curves obtained from USEPA Publication No. 430/9-80-009 entitled "Construction Costs for Municipal Wastewater Treatment Plants". Estimates of project cost will need to be redeveloped during formal facility planning for each community.

Table E-3
Estimated Treatment Plant Modification Costs for the Village of Roberts with a Mississippi River Effluent Discharge Pipeline

(Design Flow = 420,000 GPD, CPI conversion factor = 2.41)

Cost Component	1979 $	2001 $
Sitework	$60,000.00	$144,600.00
Preliminary Treatment	$34,000.00	$82,000.00
Oxidation Ditch	$280,000.00	$674,800.00
Final Clarification	$80,000.00	$192,800.00
Chemical Phosphorus Removal	$25,000.00	$60,250.00
Effluent Lift Station	$65,000.00	$156,650.00
Electrical	$85,000.00	$204,850.00
Total		$1,515,950.00

Table E-4
Estimated Treatment Plant Modification Costs for the Village of Hammond with a Mississippi River Effluent Discharge Pipeline

(Design Flow = 580,000 GPD, CPI conversion factor = 2.41)

Cost Component	1979 $	2001 $
Land Purchase and Site Prep	*	$400,000.00
Preliminary Treatment	$42,000.00	$101,200.00
Oxidation Ditch	$340,000.00	$819,400.00
Final Clarification	$98,000.00	$236,100.00
Aerobic Digestion	$160,000.00	$385,600.00
Chemical Phos Removal	$35,000.00	$84,330.00
Effluent Lift Station	$95,000.00	$229,000.00
Control Building	$140,000.00	$337,400.00
Electrical	$100,000.00	$241,000.00
Total		$2,834,030.00

*Cost estimate from engineering estimates

These costs have been cross-referenced with cost information provided on page 79 of the 14th edition of the Mean's "Heavy Construction Cost Data –2000". In this publication, several levels of costs are projected for different types and capacities of treatment systems. This document provides an estimate of $2.90/GPD for building a secondary mechanical plant such as would be required for the Village of Roberts. Using this cost rate and the design flow of 420,000 GPD for

Roberts, a cost projection of $1,218,000 for this upgrade is projected. It is expected that the cost to upgrade the Roberts wastewater treatment facility to meet the requirements of a discharge to the Mississippi River could range between $1,200,000 and $1,500,000.

The Village of Hammond's aerobic lagoon treatment system is not directly cross-referenced in the Means cost estimating manual. Using the $2.90/GPD rate established by Means for a mechanical plant, the Village of Hammond's upgrade to a capacity of 580,000 GPD is then projected to cost approximately $1,680,000. The increased cost in this analysis is mainly due to the cost for land acquisition and control building requirements.

Pipeline Route Alternatives and Selection

Many options exist for routing a treated effluent pipeline from the Central St. Croix County region to the Mississippi River below the St Croix River confluence. Each will have its own advantages and disadvantages. Each will have its own political and environmental concerns, and each will develop its own group of people in support or in opposition to it. Establishing a route is an important part of this Feasibility Study because it allows estimated costs to be developed for the implementation of this project. Evaluating the economic impact of this project is a major component of determining whether or not the project is feasible.

Ayres Associates' objective in developing a potential route for this pipeline was to locate a route that :

1. Is equally accessible as possible for all Commission member communities.
2. Is accessible to non-member communities of the region
3. Provides the shortest route possible from Commission member communities to the discharge point.
4. Provides a discharge point that is in a well-mixed zone of flow in the Mississippi River.
5. Minimizes operational systems such as lift stations, vacuum/pressure relief manholes and odor control systems, which require O&M costs.
6. Uses as much existing public right-of-way as possible so that efforts to obtain easements can be minimized.

Before the route of the pipeline could be selected, a starting point and a discharge point had to be identified.

<u>Pipeline Starting Point</u>

The starting point was selected by analyzing the USGS topographic maps for the Roberts quadrangle (7.5 minute series) and the Baldwin west quadrangle (7.5 minute series). It was noted that a natural low-point (elevation 1018) occurred centrally in between the Village's of Hammond and Roberts at the intersection of 70th Avenue and 150th Street.

This location is centered on the Warren Township and Hammond Township border. There are no residences shown at this location but a cemetery is located on the land in the southwest 1/4 of the intersection.

Treated wastewater from the Village of Roberts treatment facility would need to be pumped uphill approximately 1-3/4 miles (south along Highway 65 and east along 70th Avenue to a high-point at the corner of 70th Avenue and 130th Street (elevation 1059). From here, the treated wastewater could be allowed to flow by gravity to the wetwell of the transport lift station. The total length of the Roberts forcemain would be 3-3/4 miles.

Wastewater from the Village of Hammond's treatment facility would need to be pumped uphill approximately 3/4 mile (south along CTH "T") to a high point at the corner of CTH "T" and CTH "J" (elevation 1135). From here, the treated wastewater could be allowed to flow by gravity to the wetwell of the transport lift station. The total length of the Hammond forcemain and gravity flow piping would be approximately 3-3/4 miles.

If a joint treatment facility is remotely located equidistantly between the two Villages, then transport of untreated wastewater to the treatment plant would be needed. Treated effluent would then be transported to the transport lift station. (Review the discussion in Section F of this report for a possible location of this joint treatment system.)

The transport lift station would be constructed to service additional communities who have recently joined the Commission. Treated wastewater from the nearby communities of Baldwin and Woodville could reach the transport lift station via forcemain from these community's individual lift stations. These forcemains could discharge into the gravity portion of the Hammond forcemain and the remainder of the piping, wetwell, and lift pumps could be designed to handle this additional flow.

Pipeline Discharge Point

The most favorable discharge point for dispersal of the treated effluent into the Mississippi River would be a point where the channel of the river is the most constricted. At this point, the discharge would be dispersed into the majority of the River's flow, providing the maximum effects of dilution.

A review of 7.5' topographic maps of the Mississippi River below the St Croix River outlet southeast to near the Big River outlet, indicated that several acceptable discharge points would be available. However, this area is too far away from the Central St. Croix County pipeline starting point and is not easily accessible for the City of Ellsworth. Also, several major lift stations would be required to reach this area. For these reasons, routing of the pipeline to this area of the Mississippi River was not further considered.

Below the Big River outlet, the flow of the Mississippi River becomes more dispersed. However, there exists a point near the town of Trenton where all channels once again converge to a restriction approximately 800 to 900 ft wide. This area of convergence appears to be ideally located for a large scale effluent discharge point. It is located far enough downstream of the existing Metropolitan Council discharges and the Cities of Hastings and Prescott so that these municipal discharges have had a chance to be assimilated in the Mississippi Rivers flow. It is located above the City of Red Wing and its wastewater treatment disposal point. The river flow at this point is strong and dispersal of the effluent would be easily achieved. A properly designed "snag free" effluent diffuser is recommended for the discharge so that mixing and dispersal is enhanced. A detailed investigation of the diffuser construction and installation will be required in a future phase of this Feasibility Study if this alternative is adopted.

Below this point, the Mississippi River again becomes channelized, with the flow finally reaching the upper portion of Lake Pepin. Based on this investigation and the above discussion, the recommended discharge point for the multi-community effluent pipeline is at the convergence of the Mississippi River near the Town of Trenton.

Pipeline Routing Alternatives

Figure 1 indicates the pipeline route alternatives that were selected based on reviewing the shortest possible routes between the start point of the pipeline and the selected discharge point.

When a straight line is plotted on a map of St. Croix and Pierce Counties from the pipeline start point to the pipeline discharge point, a distance of 25.2 miles is plotted. This line extends S-SW through Warren and Kinnickinnic Townships in St. Croix County and River Falls, Trimbelle and Trenton Townships in Pierce County. When practically considered, a pipeline that follows this straight line is not possible. Very few of the existing public right of ways are available to use and there would need to be numerous lift stations to overcome the elevational changes encountered.

However, in following this straight line, some insight and knowledge is gained regarding the possible routes. First, the line is centered approximately equi-distant from the Cities of Ellsworth and River Falls. A pipeline closely following this line would be equally accessible. Secondly, it is noted that the Trimbelle River follows approximately the same path. Its valley begins at a point just south of the St. Croix and Pierce County Border in Section 1 of River Falls Township. From this point, there is a natural down-gradient to the Trimbelle's discharge point on the Mississippi River. The mouth of the Trimbelle is located just upstream of the Town of Trenton and above the Mississippi River convergence point, where the pipeline's discharge point would be located. The Trimbelle's path roughly parallels the line of shortest distance. It follows logically that a pipeline could be constructed following the Valley of the Trimbelle River. It is theoretically possible that this pipeline could be made to carry flow by gravity from this point to the outfall structure at Trenton, eliminating the need for expensive lift stations. The Cities of Ellsworth and River Falls could discharge their treated effluent to the pipeline via their own effluent lift stations.

This route appears to be efficient (because of lower operational requirements), and cost-effective (because the shortest route is obtained), and usable (because all communities can reach and use it). However, one disadvantage to this route is that it does not follow existing right-of-ways. In several instances along the Trimbelle River route, there are no existing roadways, the route transfers from one roadway to another, or there appears to be too much difference in elevation near the roadway to allow for placement of the piping in the right-of-way. Therefore, to utilize this route, new easements will need to be obtained through a predominantly agricultural area. This could lead to additional conflict and opposition to the plan.

A secondary route which exclusively runs along existing roadways was identified in the event that easement acquisition along the primary route becomes an insurmountable problem. This secondary route would require an additional lift station and forcemain installed at a point along CTH "W" in Section 26 of River Falls Township. This lift station would need to be sized to handle flow from the central St. Croix County communities and also could be designed to handle the City of River Falls' effluent if this community chooses to become involved in the project. The forcemain from this lift station would be routed along various roadways over several high points to a discharge point near the junction.

of USH 10 and CTH "O". At this point, the possibility of transporting wastewater through the remainder of the Trimbelle River Valley to the outfall structure becomes very complicated. This is the point where effluent from the City of Ellsworth would be allowed to enter the piping system if that community would decide to become involved in the project.

The Trimbelle River pipeline route was inspected on May 25, 2001. The upper two-thirds of the route from transport lift station no. 1 to USH 10 is relatively straight forward. There are two alternatives for this section of the pipeline. Alternate 1 involves transport via forcemain from lift station 1 to a gravity section located in CTH "W". From here the effluent would flow by gravity to the junction of CTH "O" and USH 10. The feasibility of using this alternative route is dependent on obtaining easements for crossing large parcels of private farmland.

Alternative 2 involves maintaining gravity flow along CTH "W" to a point where a second lift station is built. This lift station would then transport the effluent in a forcemain which continues to follow area roadways to the junction of CTH "O" and USH 10. The choice between these two alternatives will depend on the ability to obtain all necessary easements for the gravity alternative and the cost differential between obtaining these easements or building a second lift station and constructing the additional 1.5 mile of forcemain that Alternative 2 requires.

The following tables geographically describe each section of the two pipeline route alternatives mentioned above from their beginning points to the discharge point. Alternative 1 route describes the entire pipeline from transport lift station no. 1 to the discharge point near the intersection of CTH "O" and USH 10. This pipeline route is also shown in Figure 1. Alternative 2 route describes the second lift station and the second portion of forcemain to the intersection of CTH "O" and USH 10.

Table E-5
Mississippi River Effluent Transport System Pipeline Route – Alternate 1
Lift Station 1 to County Highway O and USH 10 Intersection

Pipe Section Description	Type	Length
Transport Lift Station No. 1 – Corner of 70th Avenue and 150th Street	Submersible	2.009 MGD Average
1. From Transport Lift Station No. 1 South Along 150th Street	Forcemain	1 mile
2. East Along 60th Avenue to Highway J	Forcemain	1/2 mile
3. South Along Highway J to Highway W	Forcemain	2-1/2 mile
4. South Along CTH "W" to County M	Forcemain	3-1/4 mile
5. South and West from M along CTH "W" to Highway 29	Gravity	1-1/4 mile
River Falls Entry Point		4.509 MGD Ave. 13.527 Peak (20 yr)
6. South and East Along CTH "W" to Section 26 of River Falls Township	Gravity	5 mile
7. Southeast Along Trimbelle River to County Highway O and USH 10	Gravity	5-1/4 mile
Ellsworth Entry Point		5.509 MGD Ave. 16.527 Peak (20 yr)
Total		18.75 mile

Table E-6
Mississippi River Effluent Transport System Pipeline Route – Alternate 2
Lift Station No. 1 to County Highway O/USH 10 Intersection

Pipe Section Description	Type	Length
Transport Lift Station No. 1– Corner of 70th Avenue and 150th Street	Submersible	2.009 MGD Average 6.027 MGD Peak
1. From Transport Lift Station No. 1 South Along 150th Street.	Forcemain	1 mile
2. East Along 60th Avenue to County J	Forcemain	1/2 mile
3. South Along Highway J to CTH "W"	Forcemain	2-1/2 mile
4. South Along CTH "W" to County M	Forcemain	3-1/4 mile
5. South and West from M along CTH "W" to U.S. Highway 29	Gravity	1-1/4 mile
River Falls Entry Point		4.5 MGD Average
6. South and East Along CTH "W" to Section 26 of River Falls Township	Gravity	4-1/4 mile
Transport lift Station No. 2 – Corner of CTH "W" and 710th Avenue		4.509 MGD Ave. 13.527 MGD Peak
7. East Along 710th to 750th St.	Forcemain	1/4 mile
8. South Along 750th Ave. to Highway 65	Forcemain	1-1/2 mile
9. East Along Highway 35 to County J	Forcemain	1/4 mile
10. West Along County J to 640th Ave. Turn	Forcemain	2 mile
11. South Along County J to 560th Ave.	Forcemain	1-1/2 mile
12. East Along 560th Ave. to County Highway 0	Forcemain	1-1/2 mile
13. Southeast Along County Highway O to USH 10	Forcemain	1/2 mile
Ellsworth Entry Point		
Total		20.25 mile

The visual inspection of the lower one-third of the proposed route through the Trimbelle River valley indicated a very complex route. It is questionable that a gravity line could be constructed through this area. Many river crossings over the Trimbelle River would need to be made. It is more likely that a third lift station would be needed at the County Highway O/USH 10 intersection and forcemain along County Highway O would be needed to transport the wastewater effluent to the outfall area. If a lift station is needed, then the possibility of routing the forcemain along USH 10 and then along Highway 63 to the Hagar City area becomes feasible. The investigation also showed that the topography and geology of the area in Hager City is complicated, and a fourth lift station to transfer the effluent to the polishing treatment processes appears to be needed. The polishing treatment system is required to be constructed on a high point above the river so that gravity flow to the outfall can be achieved.

The following tables describe the two alternatives for this lower one-third portion of the pipeline and the final transport to the outfall. These possible piping routes and lift stations are shown on Figure 1.

Table E-7
Mississippi River Effluent Transport System Pipeline Route – Alternative 3
County O/Highway 10 Intersection to Mississippi River Outfall

Pipe Section Description	Type	Length
Lift Station No. 3 – County Highway O and USH 10	Wetwell/ Drywell	5.509 MGD Ave. 16.727 MGD Peak
South on County Highway O to Gravity breakpoint	Forcemain	3-1/2 mile
South from gravity breakpoint to County Highway O/County E Intersection	Gravity	4-1/2 mile
Lift Station No. 4 – County Highway O and County E	Wetwell Drywell	5.509 MGD Ave. 16.727 MGD Peak
Southeast Along County E Rd. to County K	Forcemain	3/4 mile
Southeast Along County K to the Polishing Plant near the Town of Trenton	Forcemain	1-1/2 mile
From polishing plant to Outfall	Gravity	1/4 mile
Total		10.50 mile

Table E-8
Mississippi River Effluent Transport System Pipeline Route – Alternative 4
County O/Highway 10 Intersection to Mississippi River Outfall

Pipe Section Description	Type	Length
Lift Station No. 3 – County Highway O and USH 10	Wetwell/ Drywell	5.509 MGD Ave. 16.727 MGD Peak
East Along USH 10 to Highway 35	Forcemain	3-1/4 mile
South on Highway 35 to Gravity breakpoint	Forcemain	6 mile
South from gravity breakpoint to County E/Highway 35 Intersection	Gravity	3-1/4 mile
Lift Station No. 4 – County Highway E and Highway 35	Wetwell Drywell	5.509 MGD Ave. 16.727 MGD Peak
Northwest Along County Highway E to County VV	Forcemain	1/2 mile
South Along County VV to County K	Forcemain	1/4 mile
West along County K to the Polishing Plant near the Town of Trenton	Forcemain	1 mile
From polishing plant to outfall	Gravity	1/4 mile
Total		14-1/2 mile

PHYSICAL PIPELINE DESIGN ALTERNATIVES

Pipe Sizing and Design

<u>50 –Year Design Flow Establishment</u>

Typically, 20-year flow and loading projections are used to size wastewater treatment process components and pumping systems. This time frame allows for a cost effective long term treatment system to be developed with the flexibility for change in the future to meet new or tighter effluent requirements. However, a 20-year design for the piping components of a pipeline of this magnitude is not adequate. It is too costly to relay piping along this route every 20 years as this region grows. The Metropolitan Council has interceptors within its region with lengths equal to or greater than the proposed Mississippi River Effluent Pipeline. They have typically used 50–year flow projections in the facility planning phase of these interceptors. Therefore, in order for this alternative to be cost effective, the piping within the proposed system should be sized to handle the projected 50-year flows from all six possible user communities within the region.

For the purpose of this Feasibility Study, the development of the 50-year flow requirements for a multi-community pipeline will use a modification of established growth rates projected for South Washington County in Minnesota. Washington County, Minnesota lies to the west adjacent to St. Croix and Pierce Counties of Wisconsin. This area of Washington County is now experiencing rapid growth and development that is projected for the future for St. Croix County as growth pressure from the Minneapolis/St. Paul metropolitan area expands eastward. The

"South Washington County Interceptor Facility Plan" was published by Bonostroo, et. al. in 1998. This plan projects the development of approximately 90,000 ft of major interceptor within the planning area. A 50-year population growth estimate was used to size this piping. The growth rates are established for each 10 - year period. It is assumed that the growth rate will be higher in St. Croix County than in Washington County for the next 50 years because the developable land in Washington County will begin to be saturated and force development pressure further east. It is assumed that the projected 30, 40, and 50 year growth rates for the St Croix and Pierce Counties in this region may be as much as twice as high as the Washington County growth rates for these same years.

Tables E-9 and E-10 presents development of estimated 50-Year flow rates developed for the sizing of the pipeline components. It is assumed that sizing for full flow capacity from all six St. Croix and Pierce County communities will be required.

Table E-9
St Croix and Pierce County Multi-Community
50-Year Regional Population Projections

Year	Washington County Growth Rate/Year Projections (Bonostroo, 1998)	St. Croix/ Pierce Multi-Community Growth Rate/Year (Estimated at Washington County Growth Rate X 2)	Estimated Population Equivalents for Central St. Croix County Communities	Estimated Population Equivalents with River Falls Included	Estimated Population Equivalent with River Falls and Ellsworth included
2020			31557	64414	78,886
2030	0.014408646	0.028817292	40651	82976	101,619
2040	0.012234380	0.024468760	50598	103279	126,483
2050	0.011123809	0.022256718	61859	126266	154,633

Table E-10
50-Year Flow Projections for a Multi-Community Pipeline to the Mississippi River

Year	Pipeline Section 1 Estimated Daily Flow for Central St. Croix County Communities (70 gal/cap/day)		Pipeline Section 2 Estimated Daily Flow with River Falls Added (70 gal/cap/day)		Pipeline Section 3 Estimated Daily Flow with River Falls and Ellsworth Added (70 gal/cap/day)	
	Design	Peak (X3)	Design	Peak (X3)	Design	Peak (X3)
2020	2.209 MG	6.627 MG	4.509 MG	13.527 MG	5.509 MG	16.527 MG
2030	2.846 MG	8.538 MG	5.808 MG	17.424 MG	7.113 MG	21.339 MG
2040	3.542 MG	10.626 MG	7.230 MG	21.690 MG	8.854 MG	26.562 MG
2050	4.330 MG	12.990 MG	8.839 MG	26.517 MG	10.824 MG	32.472 MG

Pipeline Section Sizing

There are three sections of piping that need to be sized for cost estimating purposes. Section 1 will carry treated effluent flow from the four communities of Central St. Croix County to the point where the City of River Falls' effluent flow would be added. Section 2 will carry the combined Central St. Croix County/River Falls flow to the point where the City of Ellsworth's flow would be added. Section 3 will carry the combined flow from all communities to the polishing plant near the outfall of the piping.

Section 1 of the pipeline consists of a force main with two components. The first component consists of approximately 7 miles of forcemain and pressure/vacuum structures that extend from lift station 1 to a high point located at the junction of CTH "W" and County M in Pleasant Valley Township of St. Croix County. The 50 year average daily design flow for this section of pipe is 4.330 MGD (3006 gpm) but the piping must be able to pass a peak flow of 12.990 MGD (9020 gpm). The minimum acceptable velocity under average flow conditions is 2.0 ft/sec. It is recommended that the maximum velocity under high flow conditions should not exceed 8.0 ft/sec. Data obtained from the Cornell Pump Condensed Hydraulic Handbook indicates that a forcemain sized at 24 in. has a velocity of approximately 2.1 ft/sec at a flow of 3006 GPM and approximately 6.4 ft/sec at 9020 gpm. The pressure created on the lift station pumps, operating against an elevation change of 134 ft with a forcemain 7 miles long and 24 in. diameter, is 166 PSI. This is high, but acceptable for feasibility purposes. Therefore, the forcemain portion of Section 1 piping would be sized at 24 in. to provide capacity to the year 2050.

The gravity portion of this section comprises a drop of approximately 89 ft of elevation over a distance of 1-1/4 miles (6600 ft) from the CTH "W" /County M junction to the junction of CTH "W" /Highway 29. This is the point where the City of River Falls would discharge its treated effluent into the pipeline. The average slope over this distance is 0.01348. Calculations indicate that a full flow diameter of 21.7 in. for this section of piping is needed. Therefore, a 24 in gravity pipe will be able to handle the 50 year peak flow adequately.

Section 2 of the piping must have the capacity to handle the 50 year peak flow from both the Central St. Croix County communities and the 50 year peak flow rate from the City of River

Falls. A convergence structure located at the junction of CTH "W" and Highway 29 would allow both flows to meld together. The design requirements for this section of piping is 8.839 MGD (6138 gpm) average flow and 26.517 MGD (18,415 gpm) Peak flow. This section of piping has two alternate routes. Alternate Route 1 is consists of all gravity flow following the Trimbelle River valley from the CTH "W" /Highway 29 junction in River Falls Township of Pierce County to the Junction of USH 10 and County Highway O in Trimbelle Township of Pierce County. The elevation drop along this route is from 1063 ft to approximately 875 ft (188 ft). The distance traveled along this section of piping is about 9-1/2 miles (50,160 ft), making the average slope for this section of piping approximately 0.00375. Calculating the required full flow diameter for this section of piping, a pipe diameter of 36 in. will be able to handle the 50 year peak flow from the previously mentioned communities.

Alternate Route 2 for this section of piping involves rerouting the piping to maintain construction within existing right-of-ways. Alternate Route 2 requires the flow of wastewater from the Junction of CTH "W" and Highway 29 South along CTH "W" to the intersection of CTH "W" and 710th Avenue. At this point a second lift station would be located. The gravity portion of Alternate Route 2 piping drops 77 ft in elevation and is approximately 5 miles (26,400 ft) long.

The average slope for this section of piping is 0.00292. The flow requirements remain the same as for Alternate Route 1. The full-flow requirement for this section of piping is calculated at 38 inches. Lift station no. 2 will then transfer the wastewater via forcemain along several roadways, predominantly County J to the eastern junction of County Highway O and USH 10. The elevation change for this forcemain is 144 ft and the forcemain will undulate up and down according to the elevations encountered along the roadways being used. Approximately 6-3/4 miles (35,640 ft) of forcemain will be required along Alternate Route 2. The Cornell Pump Condensed Hydraulic manual indicates that if a 30 in. diameter forcemain is used along this portion of alternate route, a velocity of 2.8 ft/sec will be maintained. At the peak flow condition of 26.517 MGD, a velocity of 8.4 ft/sec will be attained. At the peak flow condition of 26.517 MGD, a 32 in. pipe may be a more acceptable size for this forcemain because it will then produce a maximum discharge pressure of 156 PSI. A 32 in. pipe size is recommended for this forcemain. The pressure on the pumps of the lift station using 36 in. piping will be approximately 120 PSI.

Section 3 of the pipeline extends from the junction of CTH "O" and CTH 10 to the polishing plant near the outfall on the Mississippi River. The Discharge of Section 2 will enter the wetwell of the 3rd lift station here. There are two possible routes for section of the piping. Alternate Route 3A continues to follow the Trimbelle River Valley with a 3-1/2 mile section of forcemain exiting from lift station 3. In this design, lift station 3 is required to handle the peak flow from all communities (32.472 MG). The forcemain portion of this section of piping would be located in the existing right-of-way of CTH O. This would then discharge into a 4-1/2 mile section of gravity line that runs along the roadway and through right-of–ways through the remainder of the Trimbelle Valley. This piping would discharge into lift station no. 4, located at the outlet of the Trimbelle River Valley. Lift station no. 4 is required to transport the wastewater from this point approximately 2-1/4 mile by forcemain to the effluent polishing station near the Town of Trenton.

Alternate Route 3B was just recently identified as a possibility because of the complexity of transporting wastewater through the lower portion of the Trimbelle Valley. Alternate Route 3B Transports the 26.517 MG peak flow from the Central St. Croix County Communities and River Falls Eastward along USH 10 to the intersection of Highway 35. At this point the forcemain would be made to accept flow from the City of Ellsworth, and the peak flow of 32.472 MG would be transported another 6 miles to a highpoint from which gravity flow could be used. From here the flow would be by 3-1/4 mile of gravity piping to the wetwell of lift station no. 4. Lift station no. 4 is located at the Intersection of County Highway E and Highway 35. This lift station would discharge via 1-3/4 mile of forcemain to the polishing station near the Town of Trenton.

The two alternative routes for Section 3 of the pipeline were identified during the pipeline route inspection performed on May 25, 2001. Because of the late date of development and the budget requirement of Phase 1, the hydraulic analysis and pipeline sizing of these alternative routes could not be completed. These analysis will be performed and evaluated in Phase 2 of the Feasibility Study.

Section 3 of the pipeline could possibly be built to flow entirely by gravity from the junction of USH 10 and CTH "O" to the polishing plant near the outfall on the Mississippi River, traveling mostly within the right of way of CTH "O". A convergence structure located at this point would combine the flows from Section 2 with the flow of treated effluent discharged by the City of Ellsworth. This section of gravity piping must be sized to carry the peak flow from all the communities described in this study, which is 32.472 MGD. The flow along Section 3 in this scenario will be entirely by gravity and there would be alternate routes considered. The length of this gravity section of piping is approximately 10 miles (52,800 ft) and the elevation changes from about 880 ft at the convergence structure to near 750 ft at the location of the effluent polishing plant (130 ft). The average slope of this piping is calculated at 0.00246. The 50–year design size for this section of the pipeline would be 42 inches.

Pipeline Cost Estimate

Once the possible routes and piping sizes have been established for this transport system, an estimate of the cost for construction can be established. The following tables present the preliminary estimated construction costs for each section of the main route and the Alternate Routes. Alternate Routes 3A and 3B were identified late in this analysis and their associated costs will be established in Phase 2 of this study. Lift station and effluent polishing facility cost estimates are not included as they have been developed in separate sections of this report.

Table E-11
Mississippi River Discharge Pipeline
General Pipeline Construction Costs Applicable to the Entire Project

General Pipeline Construction Costs				
1. Mobilization	L.S.	1	$50,000.00	$50,000.00
2. Soil, Pavement, and Concrete Testing	L.S.	1	$20,000.00	$20,000.00
3. Traffic Control	L.S.	1	$50,000.00	$50,000.00
4. Silt Fence (Entire Route, Each Side of Excavation)	L.F.	367,065	$1.50	$550,597.50
5. Clear and Grub	L.S.	1	$30,000.00	$30,000.00
6. Erosion Bales	L.F.	183,532	$3.00	$550,596.00
7. Fence Removal and Replacement	L.S.	1	$15,000.00	$15,000.00
Subtotal				$1,266,193.50

Table E-12
Mississippi River Discharge Pipeline
Section 1 Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville)

Design Conditions: 4.33 MGD Average; 12.99 MGD Peak

Section 1 - Piping Costs				
1. Survey	Mile	8.64	$2,500.00	$21,500.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	31.4	$3,000.00	$94,200.00
4. 24 in. Forcemain (duct iron, cement lined, mech. jnt.)	L.F.	38,860	$75.00	$2,914,500.00
5. 24 in. Bends (90)	L.F.	3	$3,350.00	$10,050.00
6. 24 in. Bends (45)	L.F.	2	$2,700.00	$5,400.00
7. Air/Vacuum Relief Manholes	Each	7	$2,500.00	$17,500.00
8. Trenching (4 in. wide, 8 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction and removal of spoils	L.F.	38,860	$24.00	$932,640.00
9. 24 in. Storm Sewer (concrete, Class 3 w/gaskets)	L.F.	6,758	$40.00	$270,320.00
10. 48 in. Manhole (assumed 8 ft deep spaced 1/350 ft)	Each	20	$1,500.00	$30,000.00
11. 48 in. Manhole Lid	Each	20	$350.00	$7,000.00
12. 48 in. Manhole Base	Each	20	$350.00	$7,000.00
13. Trenching (4 in. wide, 8 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils)	L.F.	6,758	$24.00	$162,192.00
14. Restoration (Type D)	S.Y.	152,064	$5.00	$760,320.00
15. Convergence Structure	Each	1	$15,000.00	$15,000.00
Subtotal				$5,497,622.00

Table E-13
Mississippi River Discharge Pipeline
Section 2 – Alternate Route 1 Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville, River Falls)

Design Conditions: 8.839 MGD Average; 26.517 MGD Peak

Section 2 – Alternate Route 1 Piping Costs				
1. Survey	Mile	10.25	$2,500.00	$25,625.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	37.3	$6,000.00	$223,800.00
4. 36 in. Storm Sewer (concrete, Class 3 w/gaskets)	L.F.	54,120	$93.00	$5,033,160.00
5. 60 in. Manhole (assumed 8 ft deep spaced 1/350 ft)	Each	155	$2,300.00	$356,500.00
6. 60 in. Manhole Lid	Each	155	$500.00	$77,500.00
7. 60 in. Manhole Base	Each	155	$500.00	$77,500.00
8. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils	L.F.	54,120	$39.00	$2,110,680.00
9. Restoration (Type D)	S.Y.	180,400	$5.00	$902,000.00
10. Convergence Structure	Each	1	$15,000.00	$15,000.00
Subtotal				$9,071,765.00

Table E-14
Mississippi River Discharge Pipeline

Section 2 – Alternate Route 2 Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville, River Falls)

Design Conditions: 8.839 MGD Average; 26.517 MGD Peak

Section 2 – Alternate Route 2 Piping Costs				
1. Survey	Mile	11.99	$2,500.00	$29,975.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	43.6	$3,000.00	$130,800.00
4. 42 in. Storm Sewer (concrete, Class 3 w/gaskets)	L.F.	22,490	$140.00	$3,148,600.00
5. 72 in. Manhole (assumed 10 ft deep spaced 1/350 ft)	Each	64	$3,300.00	$211,200.00
6. 72 in. Manhole Lid	Each	64	$600.00	$38,400.00
7. 72 in. Manhole Base	Each	64	$600.00	$38,400.00
8. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils.	L.F.	22,490	$39.00	$877,110.00
9. 36 in. Forcemain (duct iron, cement lined, mech. jnt.)	L.F.	40,815	$220.00	$8,979,300.00
10. 36 in. Bends (90)	L.F.	7	$5,025.00	$35,175.00
11. 36 in. Bends (45)	L.F.	10	$4,050.00	$40,500.00
12. Air/Vacuum Relief Manholes	Each	5	$5,000.00	$25,000.00
13. River Crossings	Each	2	$50,000.00	$100,000.00
14. Road Repair	S.Y.	22,667	$30.00	$680,010.00
15. Rock Excavation	L.F.	10,200	$30.00	$306,000.00
16. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils	L.F.	40,815	$39.00	$1,591,785.00
17. Restoration (Type D)	S.Y.	211,024	$5.00	$1,055,120.00
18. Convergence Structure	Each	1	$15,000.00	$15,000.00
Subtotal				$17,552,375.00

Table E-15
Mississippi River Discharge Pipeline
Section 3 - All Gravity Scenario
Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville, River Falls, Ellsworth)

Design Conditions: 10.824 MGD Average; 32.472 MGD Peak

Section 3 – Piping Costs				
1. Survey	Mile	10.48	$2,500.00	$26,200.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	38.1	$3,500.00	$133,350.00
4. 42 in. Storm Sewer (concrete, Class 3, w/gaskets)	L.F.	56,548	$140.00	$7,916,720.00
5. 72 in. Manhole (assumed 10 ft deep spaced 1/350 ft)	Each	162	$3,300.00	$534,600.00
6. 72 in. Manhole Lid	Each	162	$600.00	$97,200.00
7. 72 in. Manhole Base	Each	162	$600.00	$97,200.00
8. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils	L.F.	56,548	$39.00	$2,205,372.00
9. River Crossings	Each	5	$150,000	$750,000.00
10. Rock Excavation	L.F.	21,200	$30.00	$636,000.00
11. Roadway Patch and Repair	S.Y.	64,500	$30.00	$1,935,000.00
12. Restoration (Type D)	S.Y.	188,493	$5.00	$942,465.00
Subtotal				$15,524,107.00

Table E-16
Mississippi River Discharge Pipeline
Section 3 – Alternate Route 1 Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville, River Falls, and Ellsworth)

Design Conditions: 10.824 MGD Average; 32.472 MGD Peak

Section 3 – Route 1 Piping Costs				
1. Survey	Mile	10.48	$2,500.00	$26,200.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	38.1	$3,500.00	$133,350.00
4. 42 in. Storm Sewer (concrete, Class 3, w/gaskets)	L.F.	24,710	$140.00	$3,459,400.00
5. 72 in. Manhole (assumed 10 ft deep spaced 1/350 ft)	Each	71	$3,300.00	$234,300.00
6. 72 in. Manhole Lid	Each	71	$600.00	$42,600.00
7. 72 in. Manhole Base	Each	71	$600.00	$42,600.00
8. River Crossings	Each	5	$50,000.00	$250,000.00
9. Road Repair	S.Y.	23,554	$30.00	$706,620.00
10. Rock Excavation	L.F.	21,200	$30.00	$636,000.00
11. 36 in. Forcemain (duct iron, cement lined, mech. jnt.)	L.F.	30,625	$220.00	$6,737,500.00
12. 36" Bends (90)	L.F.	10	$5,025.00	$50,250.00
13. 36" Bends (45)	L.F.	20	$4,050.00	$81,000.00
14. Air/Vacuum Relief Manholes	Each	5	$5,000.00	$25,000.00
15. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils	L.F.	55,334	$39.00	$2,158,026.00
16. Restoration (Type D)	S.Y.	184,448	$5.00	$922,240.00
Subtotal				$15,755,086.00

Table E-17
Mississippi River Discharge Pipeline
Section 3 – Alternate Route 2 Piping Costs

(Serving Hammond, Roberts, Baldwin, Woodville, River Falls, and Ellsworth)

Design Conditions: 10.824 MGD Average; 32.472 MGD Peak

Section 3 – Route 2 Piping Costs				
1. Survey	Mile	14.65	$2,500.00	$36,625.00
2. Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
3. Easements (30 ft wide), w/Damages	Acres	53.3	$3,500.00	$186,550.00
4. 42 in. Storm Sewer (concrete, Class 3, w/gaskets)	L.F.	16,526	$140.00	$2,313,640.00
5. 72 in. Manhole (assumed 10 ft deep spaced 1/350 ft)	Each	48	$3,300.00	$158,400.00
6. 72 in. Manhole Lid	Each	48	$600.00	$28,800.00
7. 72 in. Manhole Base	Each	48	$600.00	$28,800.00
8. Road Repair	S.Y.	26,180	$30.00	$785,400.00
9. Rock Excavation	L.F.	18,850	$30.00	$565,500.00
10. 30 in. Forcemain (duct iron, cement lined, mech. jnt.)	L.F.	18,480	$220.00	$4,065,600.00
11. 30" Bends (90)	L.F.	2	$5,025.00	$10,050.00
12. 30" Bends (45)	L.F.	4	$4,050.00	$16,200.00
13. 36" Forcemain (duct iron, cement lined, mech. jnt.)	L.F.	42,345	$220.00	$9,315,900.00
14. 36" Bends (90)	L.F.	3	$5,025.00	$15,075.00
15. 36" Bends (45)	L.F.	4	$4,050.00	$16,200.00
16. Air/Vacuum Relief Manholes	Each	6	$5,000.00	$30,000.00
17. Trenching (6 ft wide, 10 ft deep, 1/2 c.y. bucket, 0.5 – 1.0%). Includes excavation, backfill, compaction, and removal of spoils	L.F.	77,352	$39.00	$3,016,728.00
18. Restoration (Type D)	S.Y.	25,7840	$5.00	$1,289,200.00
19. Convergence Structure	Each	1	$15,000.00	$15,000.00
Subtotal				$22,143,668.00

The following is a sum of the construction cost estimates for the sections of piping that could make up the Mississippi River Treated Effluent Transport System. The cost associated for Section 3 of the pipeline assumes an all gravity flow. The costs associated with using Alternate

Routes 3A and 3B will be identified in Phase 2 of this Feasibility Study. Two totals are provided as examples of estimated minimum and maximum costs, depending on the selection of which alternate route is chosen. For this Feasibility Study, a 23% contingency on all construction cost estimates is assumed.

Subtotal Estimated Cost for Piping Construction if Section 2 – Alternate Route 1 is used, all Section 3 is Gravity Flow	$31,359,687.00
23% Contingency	$7,212,728.00
Total	$38,572,416.00

Total Estimated Cost for Piping Construction if Section 2 – Alternate Route 2 is used and Section 3 – Alternative 2 is used	$46,459,859.00
23% Contingency	$10,685,767.00
Total	$57,145,626.00

Lift Station Requirements

Piping Section 1 requires at least one effluent lift station to support the transport of wastewater from Central St. Croix County to the discharge point into Section 2. The forcemain from this lift station must carry the wastewater approximately 8-3/4 miles to the headwaters of the Trimbelle River along CTH "W" . Based on the findings previously discussed in this preliminary investigation, the remainder of this portion of Section 1 piping can be traversed with gravity flow piping. Lift station no. 1 will be located at the beginning of the pipeline and will be sized to handle the combined flow from Hammond, Roberts, Woodville, and Baldwin. The initial design for this lift station would be for a 20–year period. The design for this lift station would provide for expandability to meet future flows beyond the year 2020. The following table lists the component requirements anticipated for this lift station. Their associated estimated cost is preliminary and is based on engineering estimates for lift station designs of similar nature.

Table E-18
Effluent Pipeline Lift Station No. 1 Requirements
20-Year Design Flow = 2.018 MGD, Peak = 6.054 MGD

Description	Quantity	Unit Cost Estimate	Total Cost
Land Purchase (Acres)	10	$4,000.00	$40,000.00
Mobilization, clearing, grubbing	1	$7,000.00	$7,000.00
Sitework	1	$7,500.00	$7,500.00
Paving and sidewalks	1	$5,000.00	$5,000.00
Pumps & Appurtenances	4	$38,500.00	$154,000.00
On-site piping and Accessories	1	$11,000.00	$11,000.00
Influent Metering and Sampling	4	$20,000.00	$80,000.00
Wetwell and Building Structures	1	$162,000.00	$162,000.00
Electrical & Controls	1	$50,000.00	$50,000.00
Emergency generator	1	$100,000.00	$100,000.00
HVAC	1	$30,000.00	$30,000.00
Subtotal			$646,500.00
25% Contingency			$161,625.00
Total			$808,125.00

If Section 2 alternate route 2 is proven to be required, a second lift station would be needed. Lift station no. 2 would be designed to handle the 20 -Year flows from lift station no. 1 and also the 20 Year flow From the City of River Falls (2.5 MGD Average). Therefore, a design for 4.518 MGD Average Flow and 13.554 MGD Peak Flow would be required. This lift station would be required to pump effluent approximately 6-3/4 mile to the intersection of CTH "O" and USH 10. The component requirements for this lift station would be the same but the capacity requirements for each component would be larger. A preliminary cost estimate of $1,031,250.00 is projected for lift station no. 2, if it is required to be built.

Lift station no. 3 would be required if gravity flow through the upper portion of the Trimbelle River route is proven to be impractical. Lift station no. 3 would have two different design criteria depending on whether the forcemain would extend through the Trimbelle River valley (Section 3 Alternate Route 1) or be routed along USH 10 to Highway 35 and south to the Mississippi River (Section 3 – Alternate Route 2). In the Section 3 – Alternate Route 1 scenario the design criteria would be the 20 year flow for all six area communities (5.509 MGD Average; 16.527 MGD Peak). As with other lift stations, the component costs are the same but the capacity has increased. A construction cost estimate of $1,100,000 is projected for lift station no. 3 if it is required to be built under the scenario described for traversing the Trimbelle River valley. If lift station no. 3 would be required under the scenario described for Section 3 – Alternate Route 2, it would have the same hydraulic capacity requirements as lift station no. 2 but would have much higher head requirements. Therefore, it is suggested that the cost estimate of $1,100,000 remain as the projection for this lift station under the Section 3 – Alternate Route 2 scenario.

The recent field investigation on May 25, 2001 indicated that a fourth lift station will most likely be needed in the lower portion of the Trimbelle River or the intersection of County E and Highway 35. At these points the surface elevation is nearing 720 ft. To get to the point near Trenton where to the proposed polishing plant and outfall structure are located, requires passing the pipeline through land with elevations that rise to near 760 ft. This is not possible using gravity piping. Lift station no. 4 would have a design flow of 5.509 GPD average and 16.527 GPD peak. It would have less head requirements than any of the lift stations so smaller pumps could be used. A construction cost estimate of $1,025,000 is projected for lift station no. 4.

Effluent Polishing System and Effluent Diffusion Requirements

Effluent quality control will be a critical part of a successful treated effluent transport system. Each individual community will be responsible for treatment to meet the effluent limitation for standard wastewater characteristics such as BOD, SS, Nitrogen, Phosphorus, and others as required by the WPDES discharge permit for this outfall. Once the proper level of treatment for these characteristics is reached, the transport system should not adversely effect the quality of the discharge. The WPDES permit for this discharge will require both flow measurement and sampling of the combined flow. It will be the responsibility of the transport system utility to require measurement and sampling of each individual community's discharge and to assess the operation and maintenance charges assessed each community.

Disinfection is a common requirement for effluent which is discharged into a receiving water that has high public use. If disinfection is required for this discharge, the process will need to be provided at the site of the discharge because the indicator organism, *fecal coliforms,* could be reintroduced back into the water from sources along the piping route itself. Also, if a minimum dissolved oxygen level in the effluent is required, this process will have to be provided at the discharge site itself. Therefore, an effluent sampling and polishing station will need to be provided at the site of the discharge. As the wastewater leaves the pipeline after its long journey to the site, it is likely that there will be gases such as hydrogen sulfide and other odor causing substances associated with it. Odor control will be critical to allow this discharge station to exist within this area. The effluent station will house the flow measurement and sampling equipment, odor control process, effluent disinfection process and a re-aeration system. A control building with laboratory and support structures is recommended.

The effluent will need to be dispersed into the flow of the Mississippi. The diffuser pipe will need to be embedded into the riverbed and extend as far into the river as possible, with flow outlets spaced evenly along the way. The diffuser outlets will need be designed to prevent clogging from sediments and also be of such a design that will prevent damage from boat anchors and other physical debris moving down the river. A detailed study of the River bottom and diffuser design will need to be incorporated in a future phase of this study if its feasibility continues to be sustained. Also, a survey of macro-invertebrate life in the area of the outfall will be required and the effect of this discharge on these species assessed.

The following table provides a cost estimate for the structures, processes and equipment required at the effluent discharge site. It is assumed that a significant purchase of land with personal property on-site will be required. This cost estimate and design is anticipated for the initial 20-year life of the facility. Expansion capability would be required to allow the outfall structure to function at the 50 year projected peak flows.

Table E-19
Cost Estimate for Effluent Discharge Pipeline Sampling and Polishing Station
(20 - Year Design Flow = 5,509,000 GPD, CPI conversion factor = 2.41)

Cost Component	1979 $	2001 $
Land Acquisition (20 Acres)*		$200,000.00
Flow Measurement and Sampling	$18,000.00	$43,000.00
Effluent Disinfection	$174,000.00	$420,000.00
Odor Control*		$200,000.00
Effluent Re-aeration	$15,000.00	$36,000.00
Effluent Control Building/ Laboratory*		$160,000.00
Outfall/Diffuser Piping	$180,000.00	$434,000.00
Subtotal		$1,493,000.00
25% Contingency		$373,250.00
Total		$1,866,250.00

Source: USEPA Cost Curves – 1980

*Cost from preliminary engineering estimates

Total Mississippi River Effluent Transport System Cost Estimate

The preceding tables, that presented pipeline section alternative cost estimates, can be mixed and matched to establish an overall cost estimate for the different possible routes that are available for the pipeline. This task is left for the reader to establish independently.

ENVIRONMENTAL CONCERNS

This section will be addressed in Phase 2 of the Feasibility Study.

EFFECTS ON HUMAN HEALTH

This section will be addressed in Phase 2 of the Feasibility Study.

POLITICAL CONCERNS

This section will be addressed in Phase 2 of the Feasibility Study.

G. WILLOW RIVER NEAR BOARDMAN DISCHARGE ALTERNATIVE

DESCRIPTION OF ALTERNATIVE

This alternative involves the transport of treated effluent from certain communities within the Central St. Croix County region to a point of discharge on the Willow River below the confluence of Tenmile Creek. Figure 4 shows a possible discharge point for this outfall. The Willow River is codified as a full fish and aquatic life stream. An effluent discharge with reasonable, achievable limits is thought to be possible. This discharge point is also desirable because the amount of flow available for assimilation of effluent wastewater is increased by the addition of Tenmile Creek's flow. The proposed discharge point is located where the stream bed narrows and flow is more rapid. This provides for maximum mixing and provides the highest natural re-aeration capability in this stretch of the river.

This alternative has limited regional applicability because of the size of the receiving stream and the distance required to transport wastewater to it. The long-term use of this discharge point by the communities of River Falls and Ellsworth is not considered practical. The use of this discharge point by the communities of Baldwin and Woodville is not economical because surface waters similar to the quality of the Willow River are available more locally for these two communities. This discharge point is thought to be a locally feasible effluent alternative for the Village's of Roberts and Hammond only.

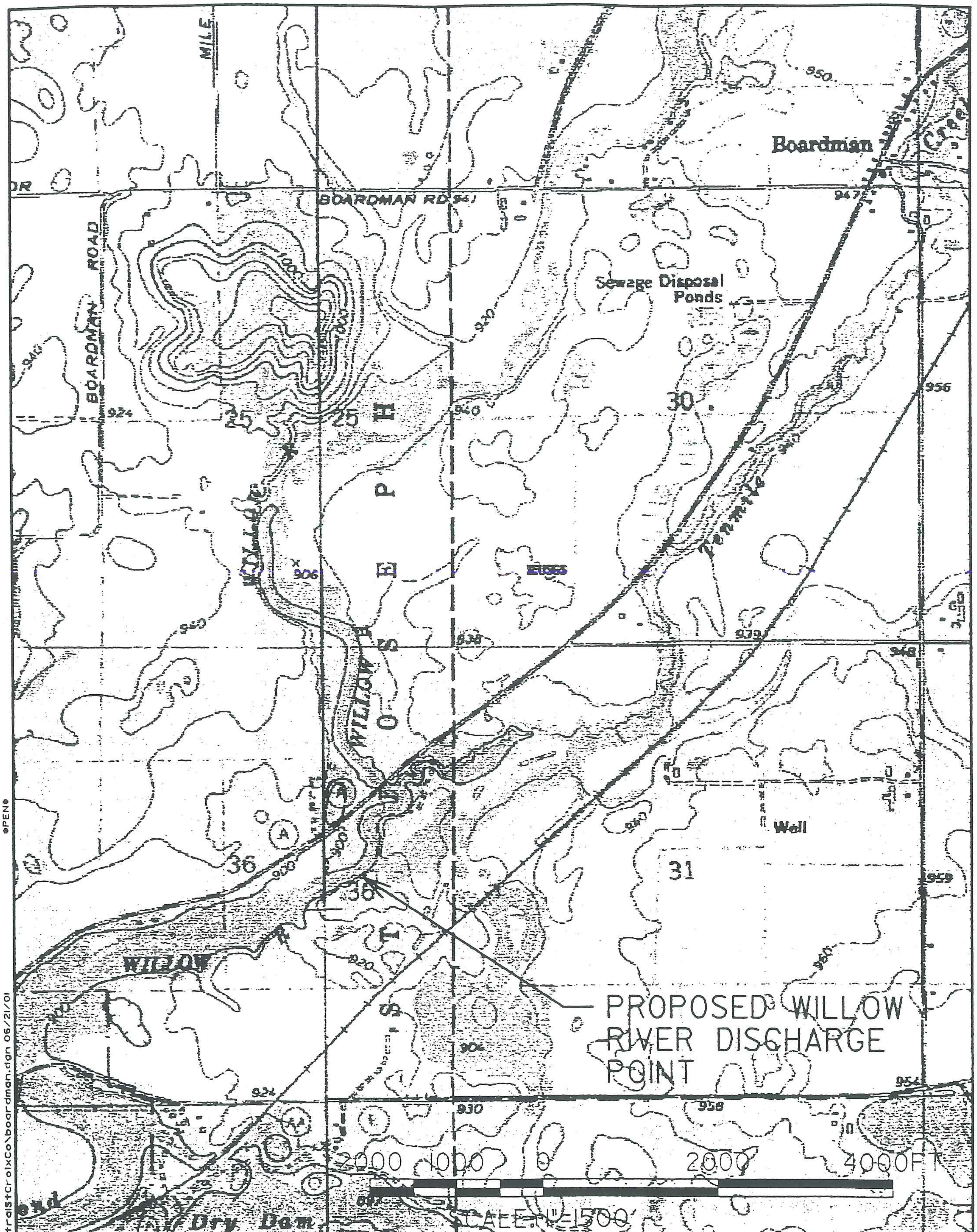
Wastewater Treatment Requirements

Effluent Limits Request

An effluent limits request for a discharge to the Willow River at was presented to WDNR in a letter dated February 2, 2001. The purpose of the effluent limits request is to begin the regulatory review process which results in calculation of the required discharge limitations from projected 20 – year wastewater loading. The loading projection for this discharge assumed that only the Village's of Hammond and Roberts would be able to use this alternative. The loading projections were based on actual existing per capita loading observed in the records of both Village's. Table G-1 shows the data that was provided to WDNR in this effluent limits request.

Table G-1
Projected Loading Rates for the Willow River Discharge Option
(Village's of Roberts and Hammond Only)

PE Equivalent for Design Considerations	14,600
Average Dry Weather Flow:	1,009,158 gpd
Peak Flow:	3,027,473 gpd
BOD Loading	3212 lbs/day (with kitchen grinding)
Suspended Solids loading	3796 lbs/day (with kitchen grinding)
Total Phosphorus loading	116.8 lbs/day
Ammonia Nitrogen Loading	102.2 lbs/day
Total Kjeldahl Nitrogen (TKN) Loading	394.2 lbs/day



CENTRAL ST. CROIX COUNTY REGIONAL WASTEWATER PLANNING COMMISSION	DRN. BY: M RICHGELS CHK. BY: J OLSON DATE: JUNE 2001 AYRES ASSOCIATES	WILLOW RIVER EFFLUENT DISCHARGE ALTERNATIVE	Fig 4

J:\ENGIN\Hudson\CentralStCroixCo\boardman.dgn 06/21/01

WDNR Response

WDNR's response to this request was placed in a correspondence prepared by Pat Oldenburg - WCR dated March 12, 2001. WDNR conceded that this discharge location is in a stretch of the Willow River designated for full fish and aquatic life use. However, WDNR stated that this discharge point was located upstream of two exceptional resource waters, the lower stretch of the Willow River from Little Falls Dam to Lake Mallalieu and the St. Croix River. The WDNR's position is that effluent limits for a discharge at this point must "be protective of the downstream exceptional resource waters" WDNR stated that this would require establishing background effluent limits for this discharge. Background levels of wastewater effluent characteristics have never been established for this portion of the Willow River. WDNR proposed that if the CSCCRWP Commission would like to continue to investigate this option, a detailed background level demonstration would be required. Table G-2 presents the specific effluent limits that were discussed in the WDNR correspondence

Table G-2
WDNR Established Effluent Limits for a Proposed Willow River Discharge Option

BOD	Background (< 5 mg/l)
Suspended Solids	Background (< 5 mg/l)
Total Phosphorus loading	Background (< 1 mg/l)
Ammonia Nitrogen Loading	Background (< 1 mg/l)
Chlorides	Background (<10 mg/l)
Heavy Metals	Background (<?)
Other	Background

SUMMARY AND CONCLUSION FOR THIS ALTERNATIVE

Based on the response prepared by WDNR regarding effluent limits for this alternative, it is the opinion of the CSCCRWP Commission that the proposed effluent limits are too restrictive and a cost-effective wastewater treatment system cannot be built for this discharge alternative. It is recommended that this alternative be eliminated from further evaluation as a surface water discharge option of member communities.

H. SUMMARY AND CONCLUSION

Phase 1 of this Feasibility Study was initiated by the Central St. Croix County Regional Wastewater Planning Commission to consider fourteen possible long-term alternatives for wastewater treatment and disposal for communities within this region. The current wastewater systems for the Village's of Roberts, Hammond, Baldwin and Woodville in Central St. Croix County were approaching design capacity and the method of effluent disposal being used by these communities will not be approved by WDNR for additional discharges. The communities of River Falls and Ellsworth in Pierce county also face similar situations. At the beginning of Phase 1 of the Feasibility Study, the Village's of Roberts and Hammond were the only members of the Commission. Therefore, this phase of the study was designed to evaluated alternatives best suited for these communities. The Village's of Baldwin and Woodville have since joined the Commission and their interests will be specifically addressed in the next phase of the project.

This phase of the Feasibility Study has been funded by a Wastewater Planning Grant provided by WDNR. At the beginning of this project, the possible wastewater treatment and discharge alternatives for the communities in this region were listed and ranked by the Commission. WDNR had stipulated that this phase of the study must analyze at least two possible alternatives. The Mississippi River Discharge Alternative was stipulated by WDNR as being one of the alternatives to be analyzed. WDNR also stipulated that the funds could not be used to analyze the St. Croix River Discharge Alternative. The Commission listed fourteen possible discharge alternatives that could be used. Of the fourteen alternatives listed, nine were recommended for elimination from evaluations in future phases of this study due to environmental, political, or economic reasoning. Five alternatives were considered for further evaluation. These were:

1. The Mississippi River Discharge Alternative – A possible long-term solution applicable to Roberts, Hammond, Baldwin, Woodville, River Falls and Ellsworth. Designated for analysis in Phase 1 of the Feasibility Study.

2. The Groundwater Disposal Alternative – A good option for smaller communities for short–term to moderate-term use. A long-term solution may need to be found to supplement the use of this alternative. Designated for analysis in Phase 1 of the Feasibility Study.

3. The Discharge to the St. Croix River Through an Existing Outfall Alternative – A possible long-term solution with much political and environmental implication. Funding could not be used in this phase of the Feasibility Study for analysis of this option. Designated for analysis in a future phase of the Feasibility Study

4. The Willow River Discharge Alternative – A possible long-term solution that could be locally applied for the Village's of Robert's and Hammond. Designated for analysis in Phase 1 of the Feasibility Study.

5. The Eau Galle River Discharge Alternative - A possible long-term solution that could be locally applied for the Village's of Baldwin and Woodville. Designated for analysis in a future phase of the Feasibility Study

The Mississippi River Discharge Alternative – The analysis of this alternative is very complex. Possible pipeline route alternatives have been identified and the economic cost for implementation has been partially completed. Further analysis is needed in a future phase of this study to select the most technically achievable route, finalize cost estimates, prepare a present worth analysis, evaluate individual community wastewater treatment and transport requirements and develop estimated User Charge Rates based on maximum community involvement. **The results of the Phase 1 investigation indicate that although complex, this alternative is technically feasible. Estimated costs for the implementation of this project are high. Its economic feasibility will be dependent on establishing funding sources which result in realistic user charge rates being established.**

The Groundwater Discharge Alternative – The analysis of this alternative has been completed and the results indicate that this alternative is an acceptable method of effluent disposal for smaller, individual communities within this region. The study showed that there are theoretically many sites of adequate size and soils within the region that fit the requirements for this alternative. The investigation of actual soil conditions on one selected site confirmed the applicability of this method. **This alternative is being recommended for short-term or intermediate-term use by smaller communities in this region to alleviate growth related wastewater treatment issues.** However, the long-term use of this alternative is questionable because of its limitation for use by only smaller communities. As growth occurs in this region, communities utilizing this disposal method may have to consider conversion to a more applicable long-term effluent disposal option if and when it becomes available. **For the Commission-member communities of Hammond and Roberts, it is recommended that facility planning for wastewater treatment improvements utilizing this effluent disposal option begin now.** Other Commission-member communities and communities within this region may wish to evaluate the applicability of this alternative to their individual situations.

The Willow River Discharge Alternative – The analysis of this alternative resulted in its elimination from consideration as a potential effluent discharge option. Because of the designation of this stream and downstream waters as Outstanding or Exceptional Resource Waters, the effluent limitations provided by WDNR for this discharge point are too severe. Background effluent limitations are not considered a technically achievable or cost-effective alternative. **No further investigation of this alternative is recommended.**

I. RECOMMENDATIONS

It is recommended that the Village's of Roberts and Hammond begin the facility planning process for wastewater treatment system improvements needed to sustain the expected growth that will occur in these communities in the next 20 years. Effluent disposal to the groundwater by means of constructed absorption ponds is recommended as part of this planning. This alternative has been proven to be a feasible short-term to intermediate-term effluent disposal method for communities of this size in this region. Effluent disposal by this method should be located in a rural setting away from planned development and should be provided with an adequate buffer zone to limit human contact.

It is also recommended that a second phase of this regional Feasibility Study be performed to supplement the analysis of the Mississippi River Discharge alternative and to consider other alternatives available for Commission–member communities. The following is a breakdown of the workscope projected for Phase 2 of the Central St. Croix County Regional Wastewater Treatment Feasibility Study. The estimated amount of engineering time and the cost to perform this work is also provided and includes required expenses.

1. Project Management – Attend Commission meetings to report on the progress of the project and to obtain input form member communities. Attend public hearings and informational meetings that may result from work done by the Commission. Take notes and publish meeting minutes. Communicate with the Commission, WDNR, and governmental representatives throughout the project.

   Hours – 120
   Cost - $8,500.00

2. Perform a detailed analysis of the central and lower portion of the proposed pipeline from the Highway 29/County W intersection to the proposed effluent outfall on the Mississippi River. The objective of this analysis is to determine which alternative routes should be selected so that a holistic pipeline cost can be established. This scope of work will include detailed field inspections and geological exploration to determine construction feasibility. A section of the Phase 2 report will be dedicated to the presentation of the results of this investigation.

   Hours – 80
   Cost - $7,000.00

3. Establish costs for the required wastewater treatment upgrades and transport systems for each community which is a potential user of this pipeline. Establish a holistic, present worth analysis of the complete Mississippi River Discharge Alternative, including individual community upgrade costs, and determine a regional User Charge for this system. Determine what amount of subsidy that would be required to establish a cost–effective User Charge for this regional system wastewater treatment. Write section of report summarizing this investigation.

   Hours – 70
   Cost -$5,000.00

4. Finalize the discussion on the Environmental, Human Health and Political implications for the Mississippi River Alternative.

Hours – 40

Cost - $3,000.00

5. Determine by reviewing existing data whether the groundwater discharge alternative is feasible for the Village of Baldwin. Write a section of the report summarizing the results of this investigation. (The Village of Woodville currently uses this method of discharge, which could be expanded if needed in the future.)

Hours – 30

Cost - $2,500.00

6. Obtain data from effluent limits requests for a multi-community discharge of treated effluent to the Eau Galle River and determine if this discharge alternative is feasible for the discharge of the Village's of Baldwin and Woodville's wastewater effluent. If favorable effluent limits are received, select a pipeline route and estimate construction costs. Write a summary of the results of this investigation.

Hours – 60

Cost - $4,500.00

7. Obtain data and request effluent limits for an increased discharge to the St Croix River through the existing outfall for the City of Hudson. The increased discharge would be equal to the flow from the Central St. County communities who are members of the Commission plus the additional flow projected for the City of Hudson. If favorable effluent limits are received, select a pipeline route and project construction costs. Write a section of this report summarizing the results of this investigation, including discussion of the environmental, Human Health and Political concerns.

Hours – 80

Cost - $6,500.00

8. Perform Miscellaneous tasks and respond to requests for information generated by WDNR staff. Attend additional meetings not scheduled as part of the above workscope.

Hours – 40

Cost - $3,000.00

Total engineering hours to complete the workscope for Phase 2 of this Feasibility Study = 500

Total Cost estimate for completing Phase 2 of the project = $40,000.00

Proposed Time Frame for Phase 2 Project:

WDNR acknowledges grant for Phase 2 – August 1, 2001.

Field work and route exploration completed – November 1, 2001.

Draft Phase 2 report due – March 1, 2002.

Phase 2 report completed and submitted – June 1, 2002.

By submission of this report, a Wastewater Planning Grant for the above Scope of Services to be provided as Phase 2 of the Central St. Croix Co. Wastewater Treatment Planning Feasibility Study is hereby requested by the Central St. Croix County Regional Wastewater Planning Commission.

John Bond Vice President

President – CSSSRWP Commission

Appendix A

Effluent Limit Calculations

Post-it® Fax Note 7671	Date 3/23	# of pages ▶ 7
To PETE SKORSETH	From MASNADO	
Co./Dept.	Co.	
Phone #	Phone # 608/267-7658	
Fax #	Fax #	

CORRESPONDENCE / MEMORAN

DATE: March 12, 2001 FILE REF: 3200

TO: Scott Boran – WT/2

FROM: Bob Masnado - WT/2 3/23/01

SUBJECT: Effluent Limits for Facility Planning Purposes for the Central St. Croix County Regional Wastewater Planning Commission.

This memorandum is in response to a request for effluent limits for facility planning purposes for the Central St. Croix County Regional Wastewater Planning Commission. This evaluation includes limits calculated to be protective of surface water quality using NR 102, 104, 207, 210, and 217. This evaluation specifically addresses the so-called "conventional pollutants" as well as nitrogen, phosphorous, and the need for disinfection.

The Commission is proposing two alternate surface water discharge scenarios. One option is the design of a facility with a design flow of 1.022 MGD with a discharge to the Willow River near Boardman. The second option is the design of a facility with a design flow of 5.522 MGD with a discharge to the Mississippi River near Hagar City. The recommended effluent limitations are as follows:

Option 1: New Discharge to the Willow River at Boardman

While the Willow River's codified use at the proposed discharge location is full fish and aquatic life, the Willow River from the Little Falls Dam to Lake Mallalieu, as well as the St. Croix River immediately downstream of the lake, is classified as an exceptional resource water. Limits given for a discharge to the Willow River must be protective of the downstream exceptional resource water. Effluent limitations for a new discharge at this proposed site would be set equal to the background levels upstream or adjacent to the discharge site as per s. 207.03(4)(b). Both BOD_5 and TSS limits would likely be below 5 mg/L. Ammonia and phosphorous limitations could also be expected to be well below 1 mg/L. Be advised that limitations for chlorides as well as other substances (metals) identified in ch. NR 105 would be issued for a discharge to surface water. Limitations for those substances would be set equal to representative background concentrations or concentrations necessary to meet the water quality criteria of ch. NR 105, whichever is more stringent. Should the permittee choose to pursue this option, Department staff will help identify existing data sources to document background water quality and suggest ways the permittee can gather and submit its own background data.

Option 2: New Discharge to the Mississippi River near Hagar City

The Mississippi River at Hagar City is classified as full fish and aquatic life water. It should be noted that these limitations are based on the entire flow of the Mississippi River at the discharge location. There is some concern over the location in that downstream of the proposed outfall

Addendum 1:
Water Quality-Based Effluent Limitations for the Central St. Croix County Regional Wastewater Planning Commission

Prepared by:
Pat Oldenburg - WCR
12 March, 2001

Background

The Central St. Croix County Regional Wastewater Planning Commission has been established to explore long term wastewater treatment and disposal alternatives for its member communities (currently the Villages of Roberts and Hammond). The Commission is proposing two alternate surface water discharge scenarios. One option is the design of a facility with a design flow of 1.022 MGD with a discharge to the Willow River near Boardman. This facility would mainly serve the existing member communities. The second option is the design of a facility with a design flow of 5.522 MGD with a discharge to the Mississippi River near Hagar City. There is the likely possibility that this option would include discharges from many more communities. This option includes flows from Roberts, Hammond, Baldwin, Woodville, Ellsworth, and River Falls.

The effluent limitations that would apply to these two options are discussed below.

Option 1: New Discharge to the Willow River at Boardman

Receiving Water & Antidegradation

While the Willow River's codified use at the proposed discharge location is full fish and aquatic life, the Willow River from the Little Falls Dam to Lake Mallalieu, as well as the St. Croix River immediately downstream of the lake, is classified as an exceptional resource water. Limits given for a discharge to the Willow River must be protective of the downstream exceptional resource water. Therefore, s. NR 207.03(4) would apply to this discharge. Briefly stated, if the new discharge is not needed to correct an existing surface or groundwater contamination or public health problem, the effluent limitations would be set equal to the background levels upstream or adjacent to the discharge site. This clause has been historically interpreted only to apply to unsewered communities with failing septic systems. Since the current member communities of Central St. Croix County Regional Wastewater Planning Commission do have existing wastewater treatment systems this exclusion does not apply, and effluent limits would be set at background. Effluent limitations for a new discharge at either of these proposed sites would be set equal to the background levels upstream or adjacent to the discharge site as per s. 207.03(4)(b). Both BOD_5 and TSS limits would likely be below 5 mg/L. Ammonia and phosphorous limitations could also be expected to be well below 1 mg/L. Be advised that limitations for chlorides as well as other substances (metals) identified in ch. NR 105 would be issued for a discharge to surface water. Limitations for those substances would be set equal to representative background concentrations or concentrations necessary to meet the water quality criteria of ch. NR 105, whichever is more stringent. Should the permittee choose to pursue this option, Department staff will help identify existing data sources to document background water

$$BOD_5\ (summer) = 2.4 * (7.0\ ^{mg}/_L - 5\ ^{mg}/_L * \frac{(3190 + 7.774)}{7.774} * 0.967^{(24.5-24)} = 1913\ ^{mg}/_L$$

$$BOD_5\ (winter) = 2.4 * (7.0\ ^{mg}/_L - 5\ ^{mg}/_L * \frac{(3190 + 7.774)}{7.774} * 0.967^{(3.8-24)} = 3{,}883\ ^{mg}/_L$$

Based on the large amount of dilution available in the receiving water, the limits will not be water quality based limits, but categorical limits established in ch. NR 210. The BOD limit calculated to prevent significant lowering of water quality would also be higher than the categorical limits provided in ch. NR 210. Therefore a weekly average BOD_5 concentration limit of 45 mg/L and a monthly average concentration limit of 30 mg/L are recommended.

The TSS limitations are primarily given to maintain or improve water clarity and are not water quality based. Suspended solids limitations are usually established as the same concentration as the BOD_5 limitations. A weekly average TSS concentration limit of 45 mg/L and a monthly average concentration limit of 30 mg/L are recommended.

pH

The pH requirement is as required under s. NR 102.04(4)(c) where the pH cannot change the estimated natural seasonal maximum or minimum pH by greater than 0.5 units, or be outside the range of 6.0 s.u. – 9.0 s.u.

Ammonia Nitrogen

The existing procedure for calculating effluent limitations is based on the application of a in-stream un-ionized ammonia nitrogen ($NH_{3(aq)}$) criterion of 0.04 mg/L after mixing with the receiving water. The 0.04 mg/L criterion takes into account background river pH and temperature, both of which influence the criterion. The general calculation procedure and information is summarized below.

In establishing ammonia nitrogen limitations where daily variables are used, the daily percent of un-ionized ammonia nitrogen must be determined. The daily percent of un-ionized ammonia nitrogen ($\%NH_{3(aq)}$) is determined by the receiving water pH and temperature.

The following equations are used to determine the percent of un-ionized ammonia:

$$\%NH_{3(aq)} = \frac{1}{1 + 10^{(pK_a - pH)}}$$

where: pH = Receiving water pH

$$pK_a = 0.09018 + \frac{2729.92}{T}$$

T = Receiving water temperature (°C) + 273.2

The total allowable ammonia ($NH_{3(aq)} + NH_4^+$) concentration is then equal to the ($NH_{3(aq)}$) criterion divided by the $\%NH_{3(aq)}$. Once the total allowable ammonia is in the receiving water is determined; a mass balance is used to determine the appropriate water quality-based effluent should be noted that the Department is currently in the process of revising its surface water quality standards for ammonia. These revisions are likely to include revisions of the existing chronic criteria along with the development of acute toxicity criteria and associated effluent limits. It may be necessary to revisit these limit recommendations based on chronic and acute criteria after these revisions are incorporated into chs. NR 105 and 106.

Phosphorous

Based on the design flow of 5.022 MGD, it is very likely that the permittee will discharge more than the 150 lb/month threshold of ch. NR 217. Therefore, a 1.0 mg/L total phosphorous limit, or an approved alternate limit, is recommended. Also, water quality based phosphorous standards are currently under development that may result in a phosphorous limitation lower than 1.0 mg/L. Therefore, the facility should be designed in a manner that will allow for future changes to meet an effluent phosphorous limitation at or possibly below 1.0 mg/L.

Disinfection

The Mississippi is used for heavily used for recreation. Therefore, disinfection will be required during summer recreational use. Disinfection will be required from May through October. If chlorine is used for disinfection, limits will be required based on acute toxicity criteria. The recommended effluent limitations would be 38 µg/L daily maximum (rounded to two significant digits).

Appendix D

Applicable WDNR Code Requirements

Chapter NR 140

GROUNDWATER QUALITY

Subchapter I— General

NR 140.01 Purpose. The purpose of this chapter is to establish groundwater quality standards for substances detected in or having a reasonable probability of entering the groundwater resources of the state; to specify scientifically valid procedures for determining if a numerical standard has been attained or exceeded; to specify procedures for establishing points of standards application, and for evaluating groundwater monitoring data; to establish ranges of responses the department may require if a groundwater standard is attained or exceeded; and to provide for exemptions for facilities, practices and activities regulated by the department.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85.

NR 140.02 Regulatory framework. (1) This chapter supplements the regulatory authority elsewhere in the statutes and administrative rules. The department will continue to exercise the powers and duties in those regulatory programs, consistent with the enforcement standards and preventive action limits for substances in groundwater under this chapter. This chapter provides guidelines and procedures for the exercise of regulatory authority which is established elsewhere in the statutes and administrative rules, and does not create independent regulatory authority.

(2) The department may adopt regulations which establish specific design and management criteria for regulated facilities or activities, if the regulations will ensure that the regulated facilities and activities will not cause the concentration of a substance in groundwater affected by the facilities or activities to exceed the enforcement standards and preventive action limits under this chapter at a point of standards application. The department may adopt more stringent regulations under authority elsewhere in the statutes based on the best currently available technology for regulated activities and practices which ensure a greater degree of groundwater protection or when necessary to comply with state or federal laws.

(3) Preventive action limits serve to inform the department of potential groundwater contamination problems, establish the level of groundwater contamination at which the department is required to commence efforts to control the contamination and provide a basis for design and management practice criteria in administrative rules. Preventive action limits are applicable both to controlling new releases of contamination as well as to restoring groundwater quality contaminated by past releases of contaminants. Although a preventive action limit is not intended to always require remedial action, activities affecting groundwater must be regulated to minimize the level of substances to the extent technically and economically feasible, and to maintain compliance with the preventive action limits unless compliance with the preventive action limits is not technically and economically feasible.

(4) The department may take any actions within the context of regulatory programs established in statutes or rules outside of this chapter, if those actions are necessary to protect public health and welfare or prevent a significant damaging effect on groundwater or surface water quality for present or future consumptive or nonconsumptive uses, whether or not an enforcement standard and preventive action limit for a substance have been adopted under this chapter. Nothing in this chapter authorizes an impact on groundwater quality which would cause surface water quality standards contained in chs. NR 102 to 105 to be attained or exceeded.

History: Cr. Register, January, 1992, No. 433, eff. 2–1–92; reprinted to restore dropped copy, Register, March, 1992, No. 435.

NR 140.03 Applicability. This subchapter and subch. II apply to all facilities, practices and activities which may affect groundwater quality and which are regulated under chs. 85, 93, 94, 101, 145, 281, 283, 287, 289, 291 and 292, Stats., by the department of agriculture, trade and consumer protection, the department of commerce, the department of transportation, or the department of natural resources, as well as to facilities, practices and activities which may affect groundwater quality which are regulated by other regulatory agencies. Health–related enforcement standards adopted in s. NR 140.10 also apply to bottled drinking water manufactured, bottled, sold or distributed in this state as required by s. 97.34 (3) (b), Stats., and to determining eligibility for the well compensation program under s. 281.75, Stats. Subchapter III applies to all facilities, practices and activities which may affect groundwater quality and which are regulated by the department under ch. 281, 283, 287, 289, 291, 292, 295 or 299, Stats. This chapter does not apply to any facilities, practices or activities on a prospecting site or a mining site because those facilities, practices and activities are subject to the groundwater quality requirements of chs. NR 131, 132 and 182. The department may promulgate new rules or amend rules governing facilities, practices or activities regulated under ch. 293, Stats., if the department determines that the amendment or promulgation of rules is necessary to protect public health, safety or welfare. The requirements of this chapter are in addition to the requirements of any other statutes and rules.

Note: The groundwater standards in this chapter do not replace the maximum contaminant levels applicable to public water systems contained in ch. NR 809. Drinking water maximum contaminant levels and health advisory levels may take into account such factors as treatment costs and feasibility for public water systems.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. **Register, December, 1998, No. 516, eff. 1–1–99.**

Pyridine	10	2
Selenium	50	10
Silver	50	10
Simazine	4	0.4
Styrene	100	10
1,1,1,2–Tetrachloroethane	70	7
1,1,2,2–Tetrachloroethane	0.2	0.02
Tetrachloroethylene	5	0.5
Tetrahydrofuran	50	10
Thallium	2	0.4
Toluene	343	68.6
Toxaphene	3	0.3
1,2,4–Trichlorobenzene	70	14
1,1,1–Trichloroethane	200	40
1,1,2–Trichloroethane	5	0.5
Trichloroethylene (TCE)	5	0.5
2,4,5–Trichlorophenoxy–propionic acid (2,4,5–TP)	50	5
1,2,3–Trichloropropane	60	12
Trifluralin	7.5	0.75
Trimethylbenzenes (1,2,4– and 1,3,5– combined)	480	96
Vanadium	30	6
Vinyl chloride	0.2	0.02
Xylene[4]	620	124

[1] Appendix I contains Chemical Abstract Service (CAS) registry numbers, common synonyms and trade names for most substances listed in Table 1.

[2] Total chlorinated atrazine residues includes parent compound and the following metabolites of health concern: 2–chloro–4–amino–6–isopropylamino–s–triazine (formerly deethylatrazine), 2–chloro–4–amino–6–ethylamino–s–triazine (formerly deisopropylatrazine) and 2–chloro–4,6–diamino–s–triazine (formerly diaminoatrazine).

[3] Total coliform bacteria may not be present in any 100 ml sample using either the membrane filter (MF) technique, the presence–absence (P–A) coliform test, the minimal medium ONPG–MUG (MMO–MUG) test or not present in any 10 ml portion of the 10–tube multiple tube fermentation (MTF) technique.

[4] Xylene includes meta–, ortho–, and para–xylene.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. table 1, Register, October, 1988, No. 394, eff. 11–1–88; am. table 1, Register, September, 1990, No. 417, eff. 10–1–90; am. Register, January, 1992, No. 433, eff. 2–1–92; am. Table 1, Register, March, 1994, No. 459, eff. 4–1–94; am. Table 1, Register, August, 1995, No. 476, eff. 9–1–95; am. Table 1, Register, December, 1998, No. 516, eff. 1–1–99; am. Table 1, boron, Register, December, 1998, No. 516, eff. 12–31–99.

NR 140.12 Public welfare related groundwater standards. The groundwater quality standards for substances of public welfare concern are listed in Table 2.

Note: For each substance of public welfare concern, the preventive action limit is 50% of the established enforcement standard.

Table 2
Public Welfare Groundwater Quality Standards

Substance	Enforcement Standard (milligrams per liter – except as noted)	Preventive Action Limit (milligrams per liter – except as noted)
Chloride	250	125
Color	15 color units	7.5 color units
Foaming agents MBAS (Methylene–Blue Active Substances)	0.5	0.25
Iron	0.3	0.15
Manganese	0.05	0.025
Odor	3 (Threshold Odor No.)	1.5 (Threshold Odor No.)
Sulfate	250	125
Zinc	5	2.5

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. table 2, Register, October, 1990, No. 418, eff. 11–1–90; am. Table 2, Register, March, 1994, No. 459, eff. 4–1–94.

NR 140.14 Statistical procedures. (1) If a preventive action limit or an enforcement standard for a substance listed in Table 1 or 2, an alternative concentration limit issued in accordance with s. NR 140.28 or a preventive action limit for an indicator parameter established according to s. NR 140.20 (2) is attained or exceeded at a point of standards application:

(a) The owner or operator of the facility, practice or activity at which a standard is attained or exceeded shall notify the appropriate regulatory agency that a standard has been attained or exceeded; and

(b) The regulatory agency shall require a response in accordance with the rules promulgated under s. 160.21, Stats. No response shall be required if it is demonstrated to the satisfaction of the appropriate regulatory agency that a scientifically valid determination cannot be made that the preventive action limit or ment. Industrial waste discharges tributary to the municipal system shall be in compliance with applicable pretreatment standards under s. NR 211.30.

(3m) MANAGEMENT PLAN. (a) A management plan shall be submitted with plans and specifications for all land disposal facilities.

(b) The management plan shall contain specific information on pretreatment processes, scheduled maintenance, vegetative cover control and removal, load and rest schedules, application rates, operational strategies for periods of adverse weather, monitoring procedures and other pertinent information.

(4) DESIGN REQUIREMENTS. (a) *Application rates.* 1. The application rate of wastewater may not exceed the long term infiltrative capacity of the soil.

2. The application rate of wastewater containing heavy metals may not exceed the soil capacity for preventing the movement of the heavy metals through the soil.

3. Multiple wastewater application areas shall be provided to allow load and rest cycles. The discharge shall be alternately distributed to individual cells of the disposal system in a manner to allow sufficient resting periods to maintain the absorptive capacity of the soil, and to allow soil conditions to become unsaturated and aerobic between loadings.

(c) *Separation from water supplies.* 1. Land disposal systems shall be separated from private water supply wells by a minimum horizontal distance of 76 meters (250 feet).

2. The minimum horizontal separation distance between a land disposal system and public water supply wells shall be determined during facilities planning in accordance with s. NR 110.09 (2) (p). In all cases the department recommends a minimum horizontal separation of 305 meters (1,000 feet) be maintained.

(e) *Storage lagoons.* Storage lagoons shall be provided for all land disposal systems which are adversely affected by winter conditions or wet weather. Storage lagoons shall be constructed in accordance with s. NR 110.24 (3) and (4).

(f) *Load and rest cycles.* Load and rest cycles for each system shall be determined based on hydrogeologic and other relevant site conditions such as soil permeability, texture, cation-exchange capacity, topography, depth to groundwater and bedrock and the wastewater characteristics.

(g) *Construction precautions.* 1. All precautions shall be taken during construction of a land disposal system to minimize compaction of absorption areas and to prevent reduction in soil infiltration rate. Project specifications shall detail the specific precautions to take, which may include no heavy equipment use and erosion control on berms.

2. Erosion control measures shall be practiced during the construction of the land disposal system to avoid erosion of soil into a surface water and into or from the land disposal system.

(5) GROUNDWATER MONITORING. (a) *Applicability.* Groundwater monitoring systems shall be installed in accordance with approved plans and

4. All unsuccessful wells, boreholes or other vertical holes and wells whose use is no longer required must be properly abandoned in accordance with s. NR 141.25.

5. Documentation of well construction, well development and abandonment shall be submitted to the department in accordance with ss. NR 141.21 and 141.25. A location map shall also be provided in accordance with s. NR 141.065.

(d) *Alternative methods and materials.* The department may approve alternative construction methods or materials for installation of groundwater monitoring wells on a case-by-case basis.

History: Cr. Register, November, 1974, No. 227, eff. 12-1-74; r. and recr. Register, February, 1983, No. 326, eff. 3-1-83; cr. (intro.), (3m), (4) (a) 3. and (4) (g), am. (2), r. and recr. (3), (4) (f) and (5), Register, November, 1990, No. 419, eff. 12-1-90.

NR 110.255 Conditions required for specific types of land disposal systems. (1) ABSORPTION POND SYSTEMS. (a) *Design and construction criteria for absorption pond systems.* 1. New absorption pond systems shall consist of a minimum of 3 individual absorption ponds of approximately equal size. Absorption pond systems consisting of 1 or 2 individual ponds may be approved by the department on a case-by-case basis if it is demonstrated that the system has effluent storage capabilities or other provisions to ensure the operation of the system in accordance with the load and rest cycles determined under s. NR 110.25 (4) (f).

2. The design hydraulic application rate for an absorption pond system shall be based on field and laboratory test results for infiltration and hydraulic conductivity. The design hydraulic application rate shall be conservatively established to allow for pond resting cycles and for a long term reduction in infiltration rate due to wastewater solids clogging the soil.

3. Multiple pond systems shall be designed and constructed to allow individual ponds to be taken out of service for resting without interrupting the discharge to the remaining ponds.

4. Wastewater effluent shall be discharged to absorption ponds such that it is evenly distributed over the entire absorption pond bottom. Effluent storage may be required to provide effluent dosing control by fill and draw operation.

5. The absorption pond bottom shall be as level as possible at all locations.

6. The shape of each absorption pond and the placement of ponds at the site must take into account the information in the hydrogeologic study required by s. NR 110.09 (8) such as the groundwater flow direction, the presence of discharge or recharge zones and the variability of soils. Infiltration areas should be oriented in relation to the direction of groundwater flow in such a manner as to minimize groundwater impacts. When possible, absorption ponds shall be constructed in areas which are not groundwater recharge areas.

7. The minimum top width of an embankment or dike shall be 12 feet if the dike is intended to provide access for maintenance vehicles on a routine basis. The minimum top width shall be 8 feet if the embankment or dike is not designed for vehicle access. Outside embankment and dike slopes may not be steeper than 3 horizontal to one vertical and shall be

properly seeded with a mixture of grasses to prevent erosion. Inside embankments and dikes may not be steeper than 2 horizontal to one vertical and shall be properly graveled or riprapped to prevent erosion. Interior ramps for maintenance vehicle access are acceptable.

8. Absorption ponds may not be constructed on backfilled material. Earthwork activities within 1 foot of the final pond surface shall be limited to times when soil conditions are dry.

9. The bottom of the absorption pond may not be closer that 5 feet to the highest anticipated groundwater elevation.

10. An absorption pond system shall be constructed on soils which meet with the following minimum requirements:

a. Soil texture may not be coarser than loamy sand (USDA soils classification) or have less than 5% passing a number 200 sieve.

b. Soil texture may not be finer than clay loam (USDA soil classification) or have liquid limits greater that 50% (unified soil classification).

c. Soil pH may not be less that 6.5.

11. A minimum separation distance of 10 feet shall be maintained between the bottom of the absorption pond and bedrock.

(b) *Discharge limitations for absorption pond systems.* Effluent limitations are as specified in s. NR 206.08 (1) (b).

(2) SPRAY IRRIGATION SYSTEMS. (a) *Design and construction criteria for spray irrigation systems.* 1. All spray irrigation systems shall be designed with a wastewater distribution system capable of loading and resting various portions of the site to optimize wastewater treatment within the soil and crop growth.

2. Spray irrigation onto frozen ground is prohibited. The department may restrict loadings during times of the year when the cover crop is not actively growing.

3. Application of wastewater to the spray irrigation system shall incorporate a rest/load cycle and application intensity such that the soil moisture holding capacity in the top foot of the soil column is not exceeded and ponding or runoff do not occur. Following wastewater application to a portion of the field, that portion shall be rested. Table 8 provides values for the maximum volume of wastewater that may be applied per load cycle and the maximum intensity of wastewater application for specific soil textures. The values in Table 8 are the maximum amount approvable unless greater values can be justified through soil testing and are approved by the department. The volume applied and the intensity sprayed may be restricted by the department to values less than those listed in Table 8 if site conditions warrant.

Table 8

Soil Texture (USDA - SCS)	Maximum Volume Applied Per Load Cycle	Maximum Intensity of Application
Sands	0.65 inches	1.00 in/hr
Sandy Loams	0.90 inches	0.90 in/hr

Appendix E

Pipeline Construction Cost Estimates

AYRES ASSOCIATES

CENTRAL ST. CROIX CO. REGIONAL WASTEWATER PLANNING COMMISSION
OPINION OF PROBABLE CONSTRUCTION COST

ject Name: River Falls Lift station Options and Costs

Date: March 21,2001

ct Number: 23-0752.00

Estimator: JEO / EMW

Total Estimate: ##############

	DESCRIPTION	UNITS	APPROX. QUANTITY	UNIT PRICE	TOTAL PRICE
	General Pipeline Construction Costs				
1	Mobilization	L.S.	1	$50,000.00	$50,000.00
2	Soil, pavement and concrete teesting	L.S.	1	$20,000.00	$20,000.00
3	Traffic Control	L.S.	1	$50,000.00	$50,000.00
4	Silt Fence (Entire Route, Each Side of Excavation	L.F.	367065	$1.50	$550,597.50
5	Clear and Grub	L.S.	1	$30,000.00	$30,000.00
6	Erosion Bales	L.F.	183533	$3.00	$550,599.00
7	Fence Removal and Replacement	L.S.	1	$15,000.00	$15,000.00
	Subtotal				$1,266,196.50
	SECTION 1 PIPING COSTS				
8	Survey	Mile	8.64	$2,500.00	$21,600.00
9	Environmental Impact Assessment	L.S.	1	$250,000.00	$250,000.00
10	Easements (30' Wide), w/Damages	Acres	31.4	$3,000.00	$94,200.00
11	24" Forcemain (duct iron, cement lined, mech. Jnt.)	L.F.	38860	$75.00	$2,914,500.00
12	24" Bends (90)	L.F.	3	$3,350.00	$10,050.00
13	24" Bends (45)	L.F.	2	$2,700.00	$5,400.00
14	Air / Vacuum Relief Manholes	Each	7	$2,500.00	$17,500.00
15	Trenching (4" wide, 8' deep, 1/2 cy Bucket, 0.5 - 1.0 % Includes Excavation, backfill, compaction & removal of spoils	L.F.	38860	$24.00	$932,640.00
16	24" Storm Sewer (concrete, Class 3 w/gaskets)	L.F.	6758	$40.00	$270,320.00
17	48" Manhole (assumed 8' deep spaced 1/350 ft)	Each	20	$1,500.00	$30,000.00
18	48" Manhole Lid	Each	20	$350.00	$7,000.00
19	48" Manhole Base	Each	20	$350.00	$7,000.00
20	Trenching (4" wide, 8' deep, 1/2 cy Bucket, 0.5 - 1.0 % Includes Excavation, backfill, compaction & removal of spoils	L.F.	6758	$24.00	$162,192.00
21	Restoration (Type D)	S.Y.	152064	$5.00	$760,320.00
22	Convergence Structure	Each	1	$15,000.00	$15,000.00
	Subtotal				$5,497,722.00
	SECTION 2 - ALTERNATE ROUTE 1 PIPING COSTS				
23	Survey	Mile	10.25	$2,500.00	$25,625.00
24	Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
25	Easements (30' Wide), w/Damages	Acres	37.3	$6,000.00	$223,800.00
26	36" Storm Sewer (concrete, Class 3 w/gaskets	L.F.	54120	$93.00	$5,033,160.00
27	60" Manhole (assumed 8' deep spaced 1/350 ft)	Each	155	$2,300.00	$356,500.00
28	60" Manhole Lid	Each	155	$500.00	$77,500.00
29	60" Manhole Base	Each	155	$500.00	$77,500.00
29	Trenching (6' wide, 10' deep, 1/2 cy Bucket, 0.5 - 1.0 % Includes Excavation, backfill, compaction & removal of spoils	L.F.	54120	$39.00	$2,110,680.00
30	Restoration (Type D)	S.Y.	180400	$5.00	$902,000.00
31	Convergence Structure	Each	1	$15,000.00	$15,000.00

AYRES ASSOCIATES

CENTRAL ST. CROIX CO. REGIONAL WASTEWATER PLANNING COMMISSION
OPINION OF PROBABLE CONSTRUCTION COST

ject Name: River Falls Lift station Options and Costs

Date: March 21,2001

ct Number: 23-0752.00

Estimator: JEO / EMW

Total Estimate: ##############

	DESCRIPTION	UNITS	APPROX. QUANTITY	UNIT PRICE	TOTAL PRICE
	General Pipeline Construction Costs				
	SECTION 3 - ROUTE 2 PIPING COSTS				
65	Survey	Mile	14.65	$2,500.00	$36,625.00
66	Environmental Impact Statement	L.S.	1	$250,000.00	$250,000.00
67	Easements (30' Wide), w/Damages	Acres	53.3	$3,500.00	$186,550.00
68	42" Storm Sewer (concrete, Class 3 w/gaskets	L.F.	16526	$140.00	$2,313,640.00
69	72" Manhole (assumed 10' deep spaced 1/350 ft)	Each	48	$3,300.00	$158,400.00
70	72" Manhole Lid	Each	48	$600.00	$28,800.00
71	72" Manhole Base	Each	48	$600.00	$28,800.00
72	Road Repair	SY	26,180	$30.00	$785,400.00
73	Rock Excavation	LF	18850	$30.00	$565,500.00
74	30" Forcemain (duct iron, cement lined, mech. Jnt.)	L.F.	18480	$220.00	$4,065,600.00
75	30" Bends (90)	L.F.	2	$5,025.00	$10,050.00
76	30" Bends (45)	L.F.	4	$4,050.00	$16,200.00
77	36" Forcemain (duct iron, cement lined, mech. Jnt.)	L.F.	42345	$220.00	$9,315,900.00
78	36" Bends (90)	L.F.	3	$5,025.00	$15,075.00
79	36" Bends (45)	L.F.	4	$4,050.00	$16,200.00
80	Air / Vacuum Relief Manholes	Each	6	$5,000.00	$30,000.00
81	Trenching (6' wide, 10' deep, 1/2 cy Bucket, 0.5 - 1.0 %	L.F.	77352	$39.00	$3,016,728.00
	Includes Excavation, backfill, compaction & removal of spoils				
82	Restoration (Type D)	S.Y.	257840	$5.00	$1,289,200.00
83	Convergence Structure	Each	1	$15,000.00	$15,000.00
	Subtotal				$22,128,668.00
	Subtotal Estimated Cost for Piping Construction if Aternate Route 1 is Used				$31,360,790.00
	25% contingency				$7,212,981.70
	Total				**$38,573,771.70**
	Total Estimated Cost for Piping Construction if Aternate Route 2 is Used				$46,444,961.50
	25% contingency				$10,682,341.15
	Total				**$57,127,302.65**

Engineers/Architects/Scientists/Photogrammetrists
3433 Oakwood Hills Parkway, P.O. Box 1590, Eau Claire, WI 54702-1590, (715) 834-3161, Fax (715) 831-7500

Appendix M

Technical Excerpt from Wisconsin Department of COMM Environmental Impact Statement for COM83 Rule Implementation

the point where domestic wastewater leaves the onsite sewage system. Because it is not feasible to measure for every possible bacteria, two indicators have typically been used in studying possible releases of bacteria from onsite sewage systems: total coliforms and fecal coliforms.

Table 3-1. Substances of Concern Found in Groundwater

Substance	Reasons for Concern	NR140 Enforcement Standard	Likelihood in Domestic POWTS	Possible source
Arsenic	Affects nervous system, causes malignant tumors of skin and lungs	0.05 mg/l	Has been detected, but rare in domestic wastewater, background levels in drinking water occur in localized areas	Industrial processing, paint and ink, defoliants, soil sterilants, natural water supply
Atrazine	Affects nervous, reproductive, and cardiopulmonary systems, liver and kidneys, may be carcinogenic	0.003 mg/l	Not typically in domestic wastewater, except where introduced via contaminated laundry.	Agricultural herbicide; normal use, spills, and cleanup
Chloride	Affects palatability of drinking water	250 mg/l	Common where water softeners are used	Naturally occurring in groundwater, human and animal excrement, Water softener salt
Coliform Bacteria	Is an indicator of potential contamination by pathogenic bacteria	Detectable	Common	Human excrement and manure
Copper	Causes stomach and intestinal distress	1.3 mg/l	Has been detected, but rare in domestic wastewater	Corrosion of pipes
Iron	Affects palatability of drinking water	0.3 mg/l	No data.	Naturally occurring in groundwater, Corrosion of pipes
Lead	Affects nervous and reproductive systems, kidneys. Causes hypertension.	0.015 mg/l	Has been detected, but rare in domestic wastewater	Corrosion of pipes,
Methylene Blue Active Substances	Affects aesthetics (causes foaming)	0.5 mg/l	Common	Household Detergents
Nitrate	Has been associated with methemoglobinemia in infants, stomach cancer, and other adverse health conditions in humans and livestock. Can cause eutrophication in nitrogen-limited ecosystems	10 mg/L	Common	Human excrement, commercial fertilizer, manure industrial waste, decaying organics
Nitrite	Same as Nitrate	1mg/L	Not commonly found	Same as nitrate
Phosphorus	Can cause eutrophication of aquatic ecosystems	None	Common	Dishwashing detergents, human excrement, fertilizer, manure
Sulfate	Affects palatability of drinking water, can have laxative effect	250 mg/l	Can be present in domestic wastewater	Naturally occurring in groundwater
Viruses	Can cause various illnesses	None	Discharged only from infected persons	Human excrement and manure
Volatile Organic Compounds	Carcinogenic, affects nervous system, liver and kidney damage.	Varies depending on substance	Common at very minute concentrations	Household products

Note: Substances and their effects are EPA National Drinking Water Standards published in the Wisconsin Water Well Association's 1998 Technical Guide

Excerpt From:
→ Final Environmental Impact Statement / 8-24-98 / Page 73
COMM 83 Rules

Total coliform bacteria as a group are not typically pathogenic. Many are naturally occurring organisms in the upper organic layer of the soil. Fecal coliform bacteria are not typically pathogenic either, but they are an easily identifiable group whose presence indicates a probable source from the intestinal tract of humans or other warm-blooded animals. For this reason, they are typically what is measured in onsite sewage system research.

If total coliforms are found in a drinking water well, it is an indication that there is a pathway for bacteria to enter the well, thus there is a potential route for pathogenic bacteria to enter the water. Total coliforms do not confirm that pathogenic bacteria *have* entered the water, i.e., that the water is unsafe for human consumption, only that a potential pathway exists. Furthermore, disease can occur in the absence of measurable coliforms in water, as in the 1993 outbreak of the protozoal infection cryptosporidiosis in Milwaukee which sickened 450,000 people. Also, the presence of total coliforms do not indicate the source of the bacteria. Likewise, the presence of fecal coliforms indicates that a potential route is available, but does not confirm that pathogenic bacteria are in the water. The presence of fecal coliforms makes it more likely that the bacteria have a human origin, but does not confirm it. Fecal coliforms can arise in wells from other sources, such as contaminated insects, particularly earwigs, that may crawl into improperly sealed well caps and fall into the water column.

In a recent survey of over 500 wells from all counties in Wisconsin, 23% of the wells tested positive for total coliform bacteria and 2.4% contained E. coli bacteria. There was no apparent correlation with geographic region (Warzecha *et al.* 1995:11). There have not been reports of outbreaks of serious waterborne diseases caused by bacteria reported in the areas served by these wells.

It is, however, difficult to accurately assess the extent of non-serious public health effects that may be caused by bacterial contamination of groundwater. The most likely effect of pathogenic bacteria ingested from water is gastrointestinal disorders. These are usually of short duration, and are not required to be reported to public health agencies, and frequently are not even reported to physicians. Human beings, moreover, develop some level of tolerance to many pathogens chronically present in the water they consume. Visitors not previously exposed to specific types of bacteria are more at risk for gastrointestinal disorders caused by bacteria that reach drinking water.

Bacterial contamination of surface waters by onsite sewage systems has also been identified. For example, water off swimming beaches around Pell Lake in Walworth County was found to have fecal coliform and fecal streptococcal bacteria levels up to 14 times above acceptable limits (DNR 1997c). In that case, the cause of this contamination was determined to be a high number of failing pre-1970 onsite sewage systems that discharged bacteria-rich effluent to the groundwater feeding the lake.

Ch. NR 140 sets a groundwater standard for total coliforms of <1 per100 ml, meaning that by the time effluent from an onsite sewage system crosses the property boundary or reaches a well, it must not cause detectable levels of these bacteria in the groundwater.

Onsite sewage system components remove bacteria in several ways, as described in Chapter 2 and Appendix B. Conventional systems use *in situ* soil, mounds use a combination of *in situ* soil and sand fill, disinfection units use ultraviolet light, chlorine or ozone, etc. If installed as designed and maintained adequately, all of these systems are effective at removing bacteria from domestic wastewater. For soil treatment systems, a recent literature review of close to 60 research studies concluded that "Movement of bacteria through well drained, fine and medium textured soils is minimal due to both adsorption and filtration" (Stoltz and Reneau 1996). However, comprehensive site evaluations are crucial to ensure that soils are adequate. This same review went on to say, "In soils with coarse textures, considerable structure, or high water tables, movement of bacteria can be significant."

While system failures are always a possibility, "failure" is not necessary for contamination to occur. No type of onsite sewage system, including those generally approved under the existing code, can ensure that all bacteria are removed all of the time. In *in situ* soil, for example, the soil treatment media cannot be completely controlled. Soil, climatic conditions, and quality and quantity of the wastewater received are highly variable. Bacterial removal may not be complete where septic tank effluent is discharged below the surface in highly permeable sandy soils with low organic content and cool temperatures. Bacteria are also not effectively removed by the soil and may reach groundwater relatively quickly if saturated flow conditions occur, such as in cracks, worm holes, voids, and other spaces in the soil that can act as conduits for the flow of water. For clogging mats (barriers created by bacterial growth that filter and treat wastewater) to form and function effectively, they need sufficient levels of organic substances in the water. And, since they are living biological communities, they need relatively constant conditions in order to thrive. Where onsite sewage systems are only periodically or seasonally used, or where they receive only highly pretreated wastewater, effective clogging mats may not form and bacteria may be more likely to reach ground or surface water. Non-fecal coliforms from the clogging mat, in the soil adjacent to the system, rather than from wastewater, may also reach groundwater.

Disinfection components can be incorporated into pre-treatment units of onsite sewage systems to remove bacteria. Examples of these components include treatment by ultraviolet light, and via oxidizing chemicals such as chlorine or ozone. Problems can arise in ultraviolet units if UV light can not reach the surfaces of all bacterial particles in the wastewater. This can occur due to turbidity or shadows cast in the wastewater. Bacteria may also be present within larger particles where UV light may not penetrate sufficiently to kill them. Regular servicing of chlorination units is necessary to insure that a sufficient supply of chlorination tablets is maintained. Another problem posed by chlorine treatment is the formation of carcinogenic trihalomethanes that occurs with the reaction of chlorine and humic substances present in soil organic matter (Rao and Melnik, 1986). Ozonation is considered to be a highly effective method of bacterial and viral disinfection. However, ozone is a highly unstable compound which must be generated onsite; a process that requires large quantities of high voltage current. This factor makes ozone less suitable for common use with a typical onsite septic system. There are no disinfection units currently approved in Wisconsin, but they could be approved by the Department's product approval process under both the current or proposed codes.

The most likely routes of bacterial contamination from failing onsite sewage systems are direct discharges and overland runoff. Soil absorption systems that exhibit proper hydraulic functioning, (i.e. non-saturated conditions) serve to purify septic effluent. Large populations of total coliform, fecal coliform, and enterococcal bacteria present in septic tank effluent are often reduced to background levels within 24 inches below the percolation trench (Bouma et al, 1972). Groundwater transport of bacteria to lakes is possible as noted by the Pell Lake study, but overall, appears to be rare from onsite sewage system that are properly sited and maintained (EPA 1983:xvi).

In most cases, because of the small size and localized effect of any single onsite sewage system, incomplete removal of bacteria from domestic wastewater would have limited adverse impacts on either groundwater or surface waters. However, adverse impacts to groundwater or surface waters may occur from a single system due to specific localized conditions. As in the Pell Lake case discussed above, increased impacts may occur if several onsite sewage systems are failing at the same time. This can occur in areas subject to periodic or seasonal high watertable rises.

Viruses are sub-microscopic agents that affect all life forms. Whether viruses themselves are living organisms has been a subject of scientific debate. There are over 100 different viruses known to be excreted by human beings (Gerba, 1984). Hepatitis A and Norwalk agent (rotovirus) have been the most infectious waterborne viruses in recent years (Stoltz and Reneau 1996).

Viruses have only recently been identified as a subject of concern in onsite sewage system studies and may present a greater pollution problem than is presently known. Because of the large number of intestinal-borne viruses, and because some virus types may mutate rapidly, virus assessment in wastewater and groundwater is difficult. Thorough viral assays are not practical or possible (Stoltz and Reneau 1997).

While some research studies have found viruses common in sewage effluent (Brown and Wolf, 1979), others have not (Harkin et al, 1979). The frequency of virus isolation and quantity of viruses recovered from sewage depends on the relative prevalence of infection, number of cases, and carriers in the community, as well as the efficiency of the method used for virus isolation (Rao and Melnik, 1986). Viruses have been suspected in some water-borne disease outbreaks when no other causative agent can be identified.

Natural die-off and adsorption are the two most important means of reducing the number of viruses. Most researchers agree that the attenuation of viruses in soil is primarily restricted to the process of adsorption (Stoltz and Reneau 1996), but the degree to which they are removed is unknown (Drewery and Eliassen 1968). Viruses have been found to be transported through groundwater to distances greater than 600 feet from their source (Allen, 1978). The most favorable conditions for removal of viruses are unsaturated soil, high clay content, and low organic content. Conversely, saturated conditions, macropore flow, high loading rates, coarse sands, and high organic content present the greatest risk for viral movement into groundwater. Organic substances in solution compete with viruses for adsorption sites on soil particles. Ultraviolet light and ozonation treatment components can kill viruses (Metcalf and Eddy 1991).

Though viruses are common components of wastewater, their presence depends upon the presence of an infected person in the household. Impacts from viruses are typically localized and sporadic, although significant numbers of people may be affected if a common water supply is contaminated (Yates 1985).

There is currently no way to predict the extent to which viruses from onsite sewage systems reach groundwater or surface water. There are no standards for viruses in groundwater at either a national or state level. Existing data suggest that the potential for virus contamination of ground or surface waters from onsite sewage systems cannot be adequately assessed. More research is needed regarding *in-situ* viral identification, enteric virus adsorption kinetics, survival times, elution conditions, and transport mechanisms (Hagedorn et al, 1981)

Protozoa and Helminths. Pathogenic protozoa (single-celled animals), helminths (parasitic worms), and their eggs are sometimes present in domestic wastewater. If ingested by human beings, these can cause illnesses which range from minor gastrointestinal episodes to the devastating effects of cryptosporidium. If pathogenic protozoa reach groundwater, they can present a contamination risk if the water is ingested without disinfection.

Onsite sewage systems, however, are effective in removing protozoa and helminths from wastewater because these organisms are large and are easily removed during filtration. These organisms could also be killed by disinfection units, although some types, such as cryptosporidium, are resistant to chlorination. In any properly functioning onsite sewage system, it is not expected that these organisms will reach groundwater or surface waters.

Nitrate is a nitrogenous compound that is highly soluble in water. Living organisms produce nitrates as products from the breakdown of proteins and other normal biological activities. Nitrate is not toxic to human beings at levels normally ingested from food or water, since it is readily excreted in the urine. About 95% of the total nitrate in typical human diets comes from vegetables and cured meats. It is estimated that, on average, less than 1% of nitrate in human diets is from drinking water. This could vary widely, depending on the level of nitrate in the water and the amount of water ingested.

Evidence that nitrate in groundwater is a public health problem is inconclusive but, it has been determined that nitrate can only become problematic in groundwater if it reaches certain concentrations. High levels of nitrate in drinking water have been associated with methemoglobinemia, a potentially fatal condition for infants under six months old. Nitrite converts hemoglobin to a form which does not transport oxygen, thus causing toxic methemoglobinemia, or "blue baby" disease. Methemoglobinemia is thought by some to occur when ingested nitrate is reduced to nitrite within the body, although others suggest that infection rather than nitrate consumption accounts for the nitrite levels because the body produces nitrite in response to infections (Harkin 1995).

The federal enforcement standard (ES) for nitrate-nitrogen in public drinking water is 10 mg/L with the preventative action limit (PAL) at 2 mg/L NO_3^--N. Wisconsin has set its groundwater standard at the same level. Natural background levels are less than 2 mg/L.